FEBRUARY 1957

Agricultural Engineering

The Journal of the American Society of Agricultural Engineers

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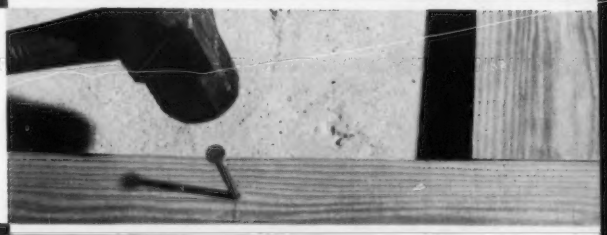
Anchorage of Buildings with Fluted Nails | 87



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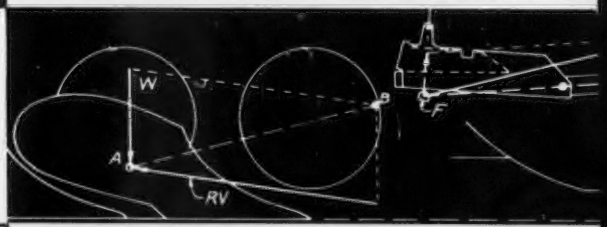

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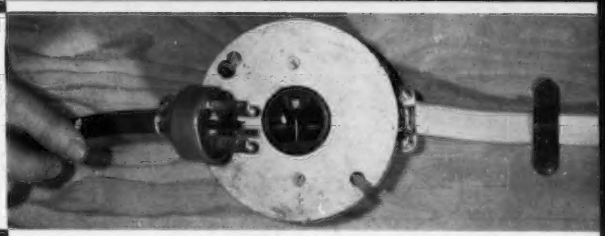

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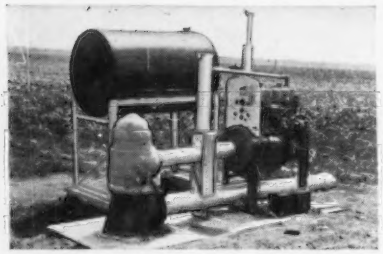
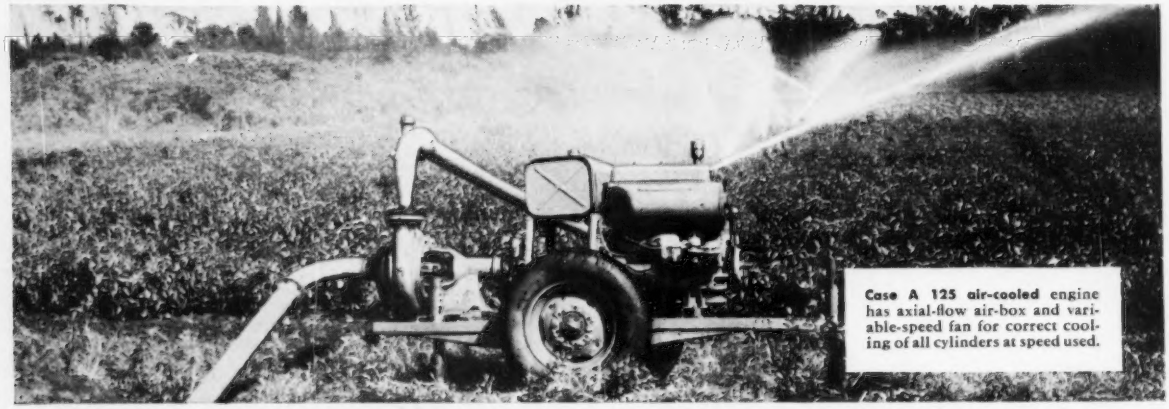
Cut Operating Costs with All-New Case Job-Matched Tractors and Engine Equipment



Case 409 diesel engine, stripped, with solid drive from flywheel to geared pump head. Cooling by heat exchanger saves fan power.

Irrigation Farming

. . . the controlled way to water crops for higher yields



Case A 125 air-cooled engine has axial-flow air-box and variable-speed fan for correct cooling of all cylinders at speed used.

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Agricultural Engineering

Established 1920

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Crowding 5000 . . .

Membership in ASAE reached an all-time high on December 31, 1956. On that date 4827 members were on record and a total of 274 applications were being processed.

The next day 115 members were dropped from the rolls for non-payment of dues and an additional 75 have submitted resignations. Total membership on January 31 was 4681 with 265 applications being processed.

ASAE's record of membership losses is quite favorable as most professional engineering societies experience a five to ten percent loss each year. The resignations and drops this year compare favorably with ASAE's own record for previous years. Transfer to other professions, retirement, and decreased interest in professional objectives are the principal reasons given for dropping membership.

ASAE resignations are concentrated around the first of the year because invoices are mailed at that time; therefore, it is the most logical time for members to review their status. Very few resignations are submitted after April 1.

The high membership renewal record of ASAE members is indicative of their enthusiasm and professional interest. Most members are keenly aware of their obligation to work toward the continual improvement of the profession they represent, the personal value of keeping abreast of agricultural engineering developments and discoveries, and the need for a medium through which agricultural engineers may work cooperatively toward the solution of common problems and the development of technically sound standards and recommendations. The result of this coordinated approach to common agricultural problems by engineers of diverse interests provides a story of engineering success and progress on American farms that is second to none of the more publicized industrial and scientific developments. This tremendous story of progress will be recognized by various speakers during the Society's Golden Anniversary Meeting this June.

Meantime, ASAE members may feel justifiably proud of the stability of their membership and regard it as a firm foundation from which the Society may expand in achievements, professional prominence, numbers, and engineering service to agriculture.

During the 49th Annual Meeting held at Roanoke in June, 1956, President Roy Bainer introduced a slogan, "50 hundred members in our 50th year."

A report on the present membership status indicates that the goal of 5000 shall be reached during 1957 and there is a possibility that President Bainer can see his prediction come true before his term of office expires.

MEMBERSHIP STATUS

"50 Hundred Members in Our 50th Year"

This slogan was originated by ASAE President Roy Bainer during the 49th Annual Meeting in June.

December 31, 1956	4827
Drops, January 1, 1957	115
Resignations, January 1, 1957	75
January 31, 1957	4681
Applications being processed	265

Usually complete processing requires about two months after application has been received by ASAE Headquarters

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Time-consuming installation problems are eliminated and costs come down when BCA pre-lubricated *package units* are used for ball bearing applications.

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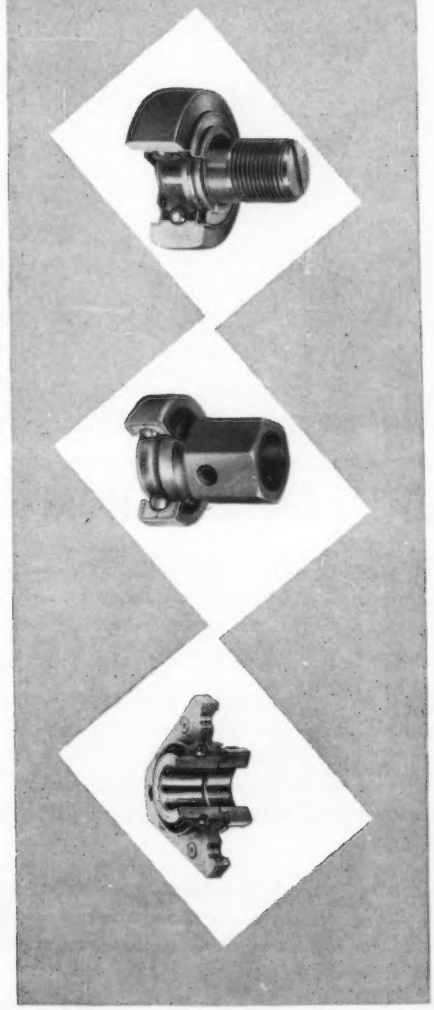

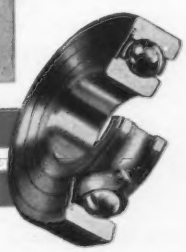

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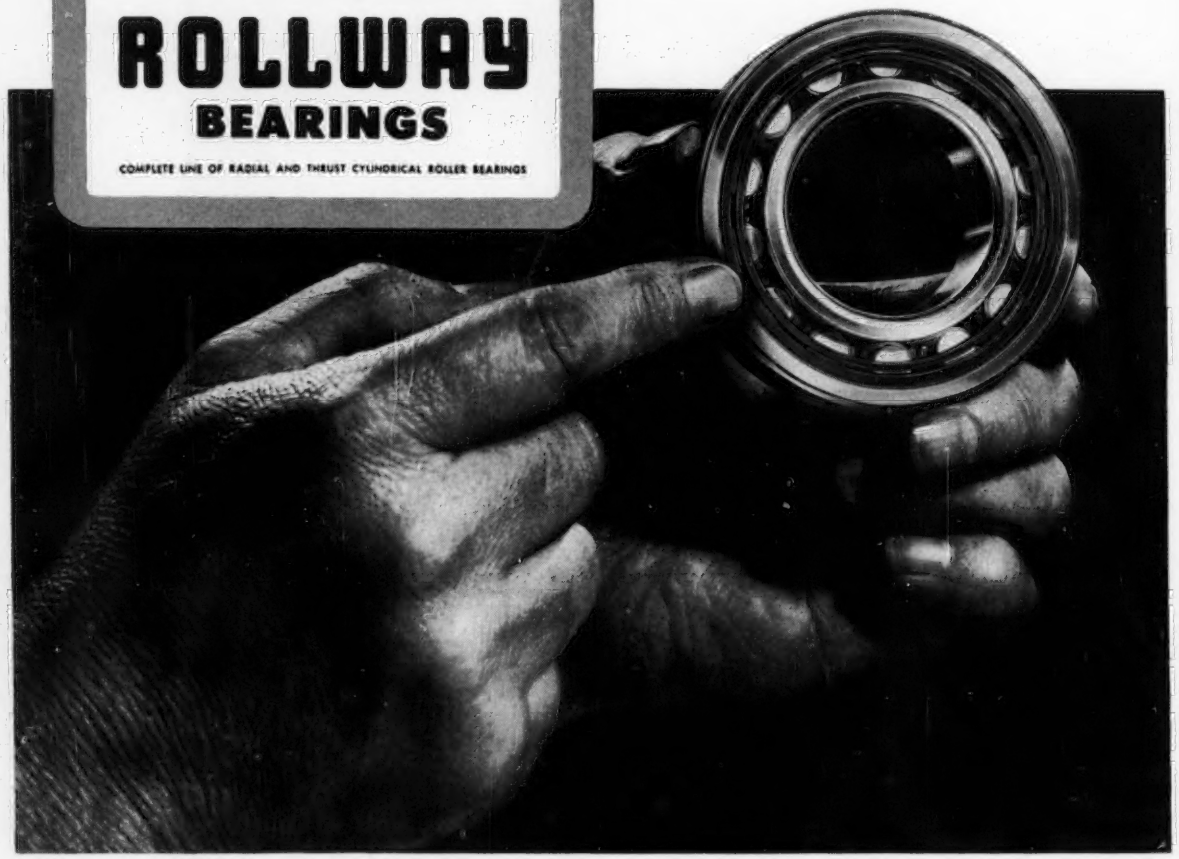


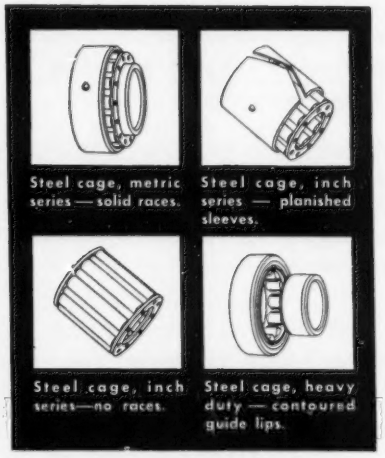
☐ TRUE or ☐ FALSE ECONOMY in Farm Implement Bearings?

✓ Meeting a cost-line by "saving" too much in such vital spots as bearings runs the risk of customer kickbacks. On the other hand, no engineer wants to specify bearings with three lives where one will do adequately.

There's truly *balanced economy* in Rollway's low-cost, quickly assembled steel-cage bearings. They are designed and built for farm service, farm maintenance and storage. They are priced in line with your cost requirements. The economies of automatic machinery and mass production permit finer engineering, materials and workmanship.

This is especially true of Tru-Rol, a bearing engineered for heavy-duty tractor applications . . . above-average efficiency at no extra cost . . . and free rolling qualities approaching that of bronze-separator types.

Let our engineers tell you about Rollway steel-cage roller bearings that will last as long as the implement or tractor. ROLLWAY BEARING CO., INC., Syracuse, N. Y.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AGRICULTURAL MACHINERY NEWS

LATEST PROPERTY AND APPLICATION DATA ON

ZYTEL® nylon resin

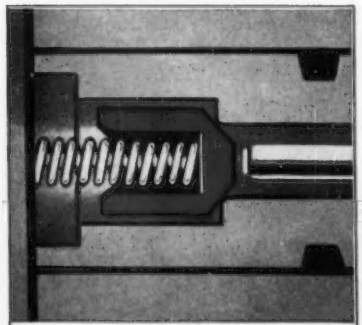
Durable parts of DuPont ZYTEL® nylon resin improve performance . . . reduce costs

Gears, bearings, cams and other farm machinery components made of Du Pont ZYTEL nylon resin can represent a considerable savings in cost. Entire assemblies have been replaced by a single molded part of ZYTEL. Substantial savings are often achieved by injection-molding parts of ZYTEL nylon resin in full-scale production. Intricate, precise shapes are possible, which often require no finishing operations.

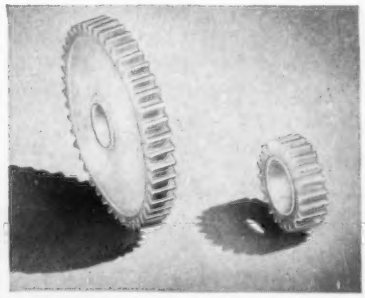
The properties of Du Pont ZYTEL are increasing the efficiency of many machine parts. ZYTEL is strong and elastic, allowing the energy of impact loads to be absorbed by displacement. Little or no lubrication is needed for parts made of ZYTEL. Large, high-strength parts can be molded in one piece. ZYTEL retains its strength in thin sections, too, and is rated for operation up to 250°F. Gears and sleeve bearings of ZYTEL have outworn metal components in tests for abrasion resistance. The chemical resistance of ZYTEL permits direct contact with a wide variety of chemicals. ZYTEL is available in colors and in highly weather-resistant forms.

Don't overlook the capabilities of Du Pont ZYTEL for improving the design of agricultural machines. You can obtain more information about ZYTEL nylon resin by clipping and mailing the coupon.

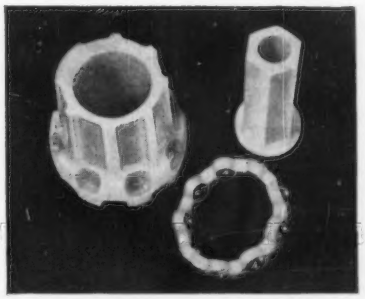
Large drive gear resists the wearing action of the cam follower moving in its 8-shaped groove. Used in textile machinery, gear is economically molded as a strong, integral unit . . . needs no lubrication. Gears of ZYTEL can often be molded directly on shafts.



LEAK-PROOF CHECK VALVE for the hydraulic lift on tractors shown above is made of Du Pont ZYTEL nylon resin. Because of its resiliency, ZYTEL provides a tight seal, even when there are slight imperfections in the mating surfaces. It is wear-resistant . . . does not become worn or grooved after repeated contact with the seat. This nylon part is molded in one piece and needs no costly machining. Du Pont ZYTEL is particularly well suited for making parts such as these which are subject to impact.



Sturdy gears of ZYTEL nylon resin operate quietly and efficiently . . . damp mechanical vibration. Injection-molded or machined from extruded bar stock, gears are durable.



Bearings and bushings of Du Pont ZYTEL feature long-wearing surfaces, excellent impact strength. Bearings need little or no lubrication, are resistant to oils, gasoline, grease.

SEND FOR INFORMATION

Mail this coupon for additional property and application data on Du Pont ZYTEL nylon resin.

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Please send me more information on Du Pont ZYTEL nylon resin.
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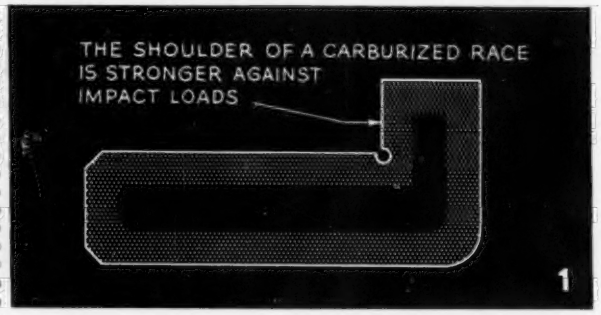
You will find full selection and application data in HYATT Catalog 150, or call your nearest HYATT Sales Engineer. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey. Sales offices at Harrison, Pittsburgh, Detroit, Chicago and Oakland, Cal.

HEAVIER INTERFERENCE FITS

Resistance to relative movement between inner race and shaft is vital to good performance. So HYATT makes practically all inner races of carburizing type nickel alloys instead of through-hardened steel. After carburizing and heat-treating, the outer surface has the hard wear resistance so necessary for an efficient bearing. The low-carbon core remains tough and ductile to permit much heavier interference fits than are otherwise possible.

TOUGHER FLANGES, GREATER LOAD CAPACITY

Carburizing also enables HYATT to obtain substantially tougher inner race flanges. Tests show the shoulders will withstand considerably greater impact loads (Figure 1). The carburizing process has also been found to increase the load-carrying capacity of the race by building up compressive hoop stresses in its external fibres during quenching.



SIMPLER, LOWER-COST MOUNTING

Another advantage of HYATT'S heavier interference fits is the elimination of all auxiliary holding devices. When the carburized inner race is either pressed or shrunk on the shaft according to HYATT fitting recommendations, it becomes practically an integral part of the shaft itself. This permits mountings of the simplest type and lowest overall cost.

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Report to Readers . . .

SELF-FEEDER SILO APPEARS TO HAVE "ARRIVED"

All who have known firsthand the onerous and hazardous job of daily removing silage by main strength and awkwardness from vertical silos, will warmly applaud what agricultural engineers at the New Jersey Agricultural Experiment Station have done to mechanize this farm "chore" job. After seven years of research they are reporting development of a self-feeder base, actually the key to solution of the self-feeding problem, that successfully controls the downward movement of silage within the silo. Mark Singley gives us the engineering story on it in this issue . . . Considered in the light of its practical and commercial significance to farmers, feeders, and machinery and silo manufacturers, this is an exciting achievement. Certainly it greatly enhances the advantages of the vertical silo – over the horizontal type – in facilitating the preservation of silage and the operations of storing and feeding. It is likely also to make the vertical silo an even more attractive item of farm equipment in the future.

STANDARDIZATION ON THE MOVE

Industry-wide standardization of parts, dimensions, capacities, etc. – all conducive to functional improvement – of farm implements and machines is now firmly established. Approved items in this category now constitute the major portion of the standards and recommendations section of our sister publication, AGRICULTURAL ENGINEERS YEARBOOK . . . Standardization activity in the farm equipment industry has advanced more slowly than in some other industries, due chiefly to natural obstacles that had to be surmounted by gradual, painstaking effort. But once industry engineers were given the green light, they put their collective hand to the plow and the record of results achieved is greatly to their credit . . . Benefits possible from well-devised standards are many. By and large, maximum benefits to both industry and users are likely to result from putting major emphasis on user requirements in developing any new standard.

SPONSORSHIP OF STANDARDS

The American Society of Agricultural Engineers has welcomed the opportunity of serving both the farming and the farm equipment industries as a sponsor of standards of benefit to both. Its membership constituted of engineers both in manufacturing organizations and in public-service agencies (largely state colleges and USDA), the ASAE is in a natural position to promulgate standards and recommendations that are generally acceptable. The Society will continue to encourage all reasonable expansion of this worth-while activity.

BETTER BLOWERS NEEDED FOR CHOPPED HAY

Floyd Duffee, Orrin Berge and other agricultural engineers at the University of Wisconsin say better blowers are needed for lifting chopped hay into barns. Aimed at improving design they have built a large-diameter blower that requires less power and is capable of handling chopped hay for mow drying about twice as fast as present models. But this isn't the last word, they say. . . . They want the chopped material moving at higher speed as it reaches the fan, so as not to pile up. They would like a kind of small-sized beater to loosen or fluff the chopped hay as it enters the blower, and revolving twice as fast as the feeding table is moving to prevent blocking the blower . . . The Wisconsin engineers also want to see more improvement in the shape of fan blades and in the outlet of the fan.

SHOCK LOAD TEST FOR V-BELTS DUPLICATES FIELD TESTING

Just out of our mailbag is the announcement that a new shock-loading test for V-belts, said to practically duplicate actual field testing, has been developed in the laboratory of a manufacturer who specializes in agricultural V-belts. This accelerated testing procedure promises to be of great help in developing special V-belts for combines and other heavy farm equipment. This should be of special significance to engineers who develop and design such equipment.

WATERING DOWN THE FARM FIRE HAZARD

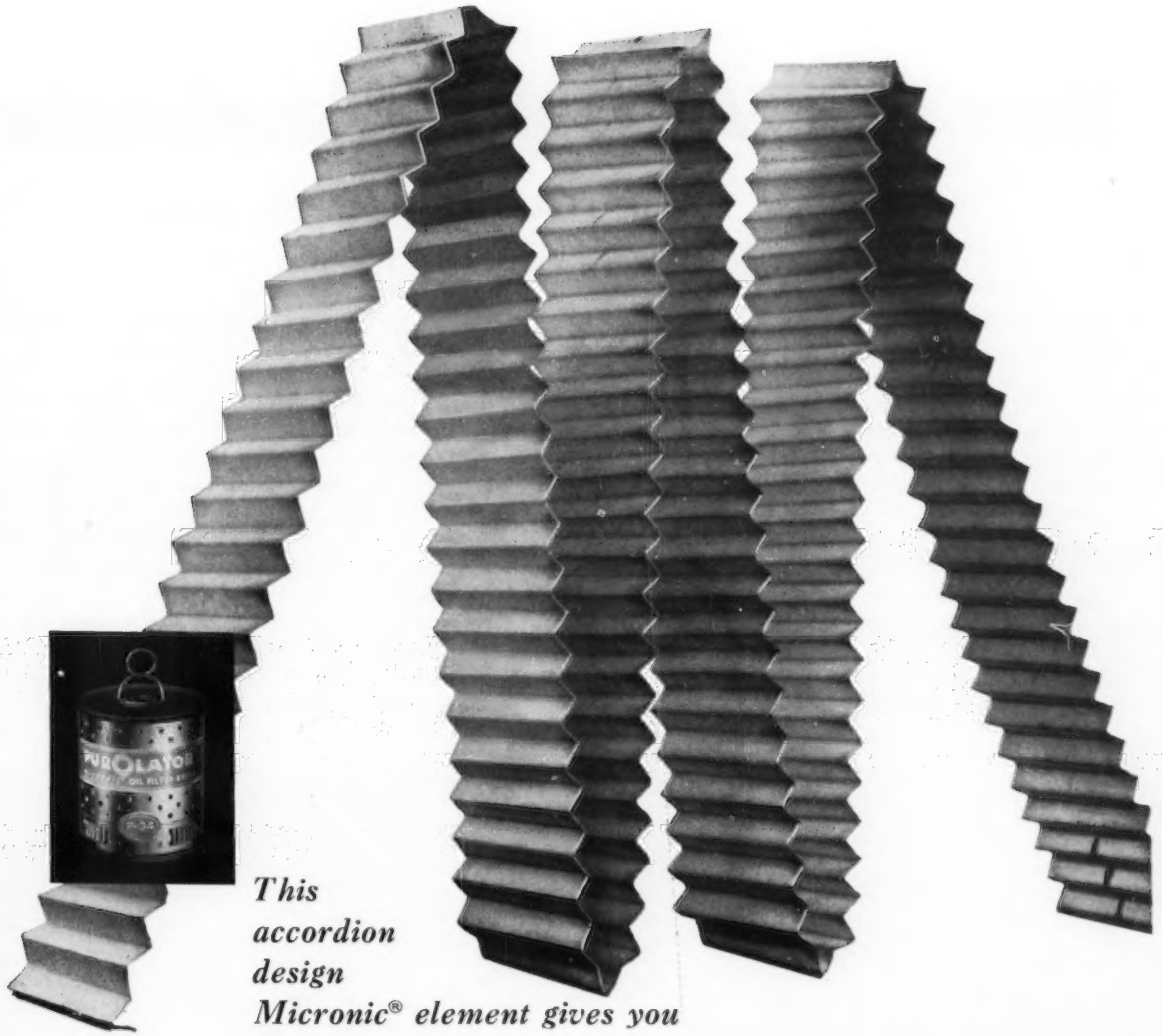
Good organization and fast, efficient motorized fire-fighting equipment can be highly effective in combating the horrible and costly menace of farm and other rural fires – IF the water supply at the scene of fire is adequate, which all too often is not the case . . . But now the Portland Cement Association comes up with an idea, not particularly new, for building large underground fire cisterns (of concrete, of course) for storing water for emergencies. With the handicap of lack of water removed, modern motorized equipment can function more nearly at maximum effectiveness . . . NFPA says fire strikes some farm every 15 minutes. Agricultural engineers in extension and other public-service agencies are in position to help reduce the farm fire hazard, by encouraging provision for convenient and adequate supplies of water, as one important means to that end. The ultimate objective, of course, is to prevent loss of human lives and many millions of dollars worth of property.

EARTHMOVING EQUIPMENT TAKES THE SPOTLIGHT

Several industry developments lately have served to focus more attention than usual on the earthmoving equipment business and the extent to which a number of the larger farm equipment manufacturers are getting their feet in the door of this rapidly expanding market. In fact, our mail has just brought an announcement that one of the original pioneers in the business, who sold his interest in it four years ago, will re-enter it again next year . . . The farm equipment industry has strong roots in the soil, and for many companies entry into the earthmoving equipment market constitutes a natural and logical development. In fact, as is well known, a few of them are already years ahead in pioneering this business . . . Another thing, as the gigantic federal highway building program gets in motion, along with current demand for larger and ever larger capacity earthmoving machines, and more and more of them, it is not unlikely that some companies will find this business exceeding that of their regular farm equipment lines.

HOW MAKE THE MOST OF ENGINEERS' WEEK

This issue of AGRICULTURAL ENGINEERING will reach readers close on the heels of Engineers' Week, February 17-23, and a natural question arises as to how engineers can best use these seven days to better acquaint the public on the role of engineers and engineering in the general economy. Obviously not a great deal can be accomplished in a single week; it's a year-round job. Apparently with this thought in mind, the editor of "General Electric Review" has significantly titled an editorial on Engineers' Week (January, 1957, issue) "Why Not Every Week?" . . . Agricultural engineers might well choose Engineers' Week as an appropriate time to really get behind a much needed activity, namely, to kindle interest among this year's crop of high school graduates, particularly in rural areas, in what a professional career in agricultural engineering has to offer. The Secretary of ASAE will welcome the opportunity of supplementing the efforts of any individual or group with appropriate subject-matter materials.



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New OWATONNA Implement

Dayton BSI* V-Belts provide dependable power under severe two way flexing

Already saving time and reducing manpower needs for hundreds of farmers all over the country, the new Owatonna Self-propelled Windrower, first of its kind on the market, is powered by Dayton V-Belts.

Making a single operation of the old mowing and side rake method, the new center delivery Owatonna implement is saving farmers up to 60% in time. Chief reason is the elimination of the back swath on the first two rounds. Cutting wastes are eliminated, too, because new fields can be opened without knocking down any of the hay or grain.

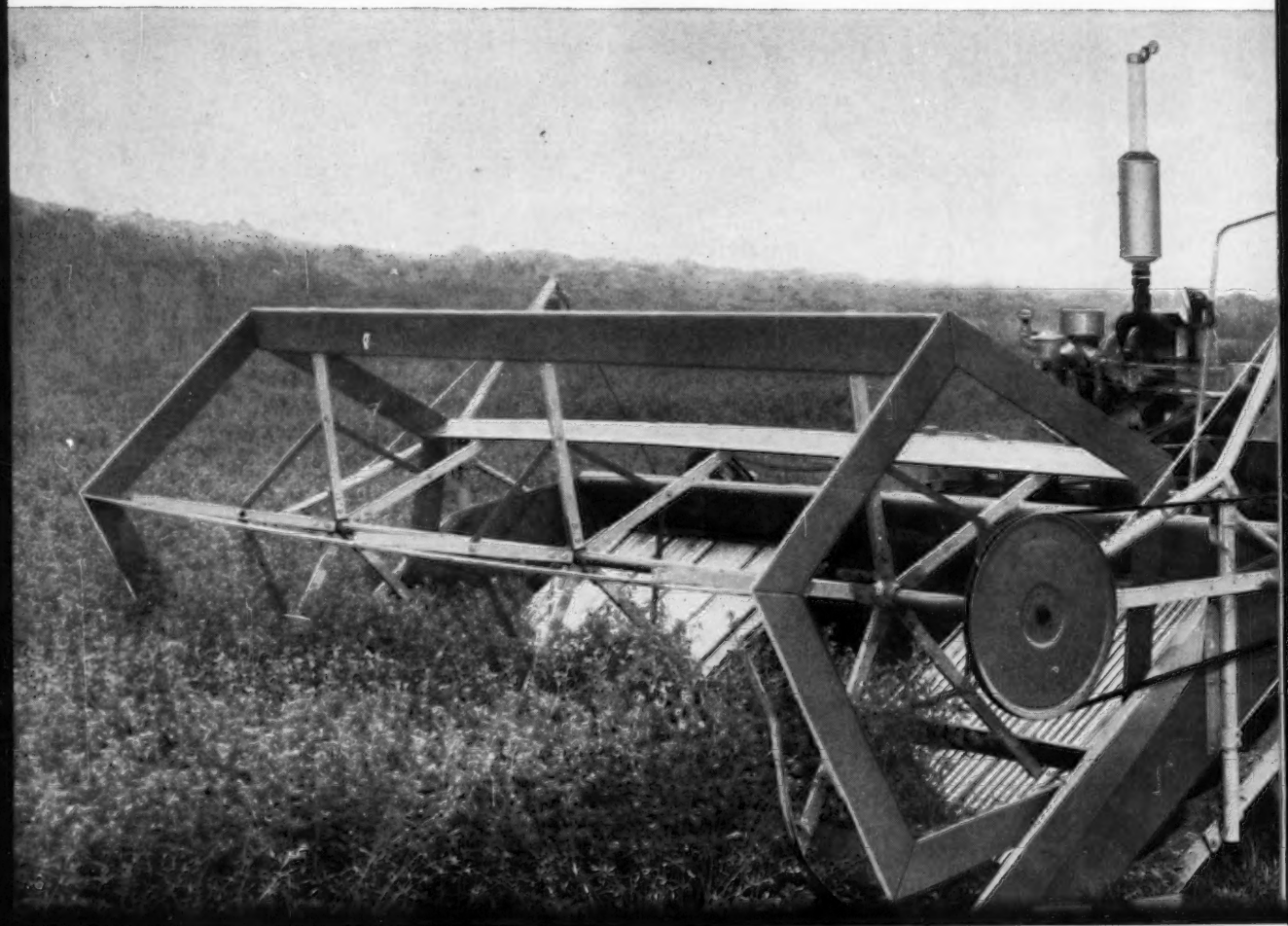
One hurdle confronting O.M.C. engineers during developmental stages was the method of keeping proper tension on the V-Belt drive for all positions of the reel.

The simplest solution was an idler, but they felt this would not give satisfactory V-Belt service life. Backbends approaching 180° were required, and no ordinary V-Belt will hold up under that kind of punishment.

The Dayton V-Belt Engineer, when asked for a recommendation, suggested use of Dayton BSI V-Belts which are specifically designed to give two way flexibility over long periods of time.

Owatonna Engineers testing Dayton BSI V-Belts were more than satisfied with performance. The V-Belts were approved and installed on all Owatonna Self-propelled Windrowers. In the field they have exceeded expectations for trouble-free service.

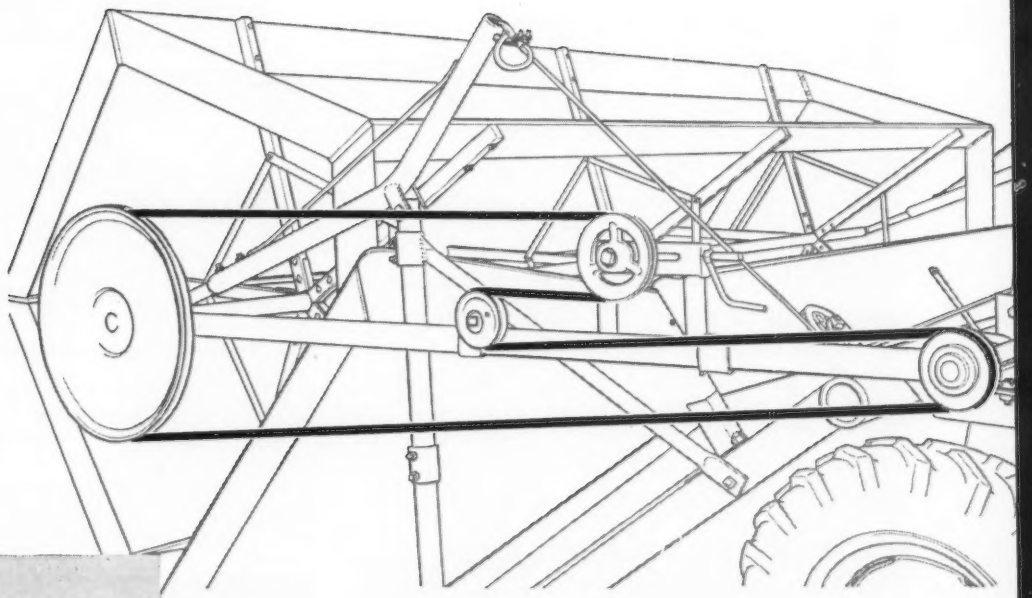
For help on your power transmission requirements consult the Dayton Agricultural Engineer. Write The Dayton Rubber Company, Agricultural O.E.M. Division. 400 West Madison, Chicago, Illinois.



For more facts circle No. 42 on reply card

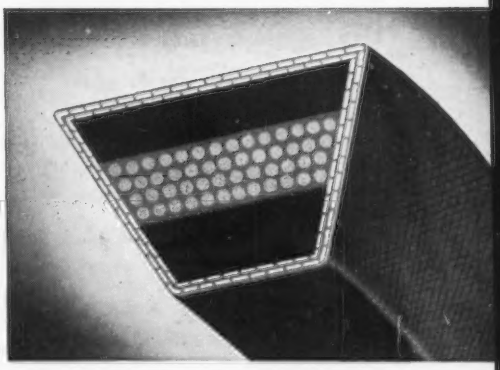
cuts windrowing time up to 60%

Speeds of 2-8 mph permit the new Self-propelled Owatonna Windrower to adjust to all crop and field conditions. Two planetary transmissions with individual wheel drives give greater maneuverability. Center delivery allows cutting close to fences and around wet or green areas, produces fluffy windrows every time.



Steady, dependable power transmission to the reel at any height is provided by Dayton BSI V-Belts. Idler properly adjusts belt tension. Note the extreme backbend. Even under bends approaching 180° around small diameter idlers Dayton BSI V-Belts give exceptional service.

Dayton BSI V-Belt is specifically designed to give two way flexibility. Extra pliable compounds on both sides of the strength section and highly resilient fabric covers assure long life under the most difficult service conditions.



© D. R. 1957

*Back Side Idler

Dayton Rubber

First in Agricultural V-Belts

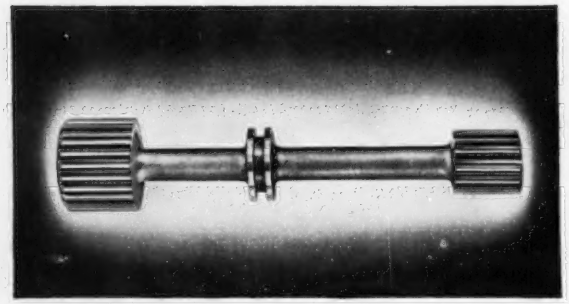
Agricultural Sales Engineers in Atlanta, Chicago, Cleveland, Dayton, Moline, New York, San Francisco and St. Louis.

For more facts circle No. 74 on reply card

Two special Armco Stainless Steels simplify production... improve farm equipment parts

Are vital parts in your products . . . pump shafts, springs, flow meters, fasteners, carburetor components or bushings, . . . failing prematurely from corrosion or fatigue? Armco 17-4 PH and 17-7 PH, two precipitation hardening stainless steels, can give these parts excellent corrosion resistance, fatigue strength, and tensile strength. In addition, these special stainless steels offer fabricating advantages over other materials.

Here are some typical examples of how Armco precipitation hardening grades increase efficiency, prolong service life, and simplify fabrication of vital machinery parts.



High fatigue strength

Under accelerated fatigue tests, this pump shaft made of Armco 17-4 PH (above) lasted 30 hours. The next best metal in the identical test was a non-ferrous alloy. It lasted nine hours. Shafts of 4140 alloy steel and Type 440 C stainless steel lasted less than one hour.

Like all Armco 17-4 PH parts, this shaft was finish-machined in the annealed condition, then fully hardened with a low temperature heat treatment (875 F for one hour). No allowance for distortion or scaling during heat treatment is necessary. Armco 17-4 PH can also be forged or cast.

ARMCO STEEL CORPORATION
2576 Curtis Street, Middletown, Ohio

Send me complete information on 17-4 PH ☐ 17-7 PH ☐

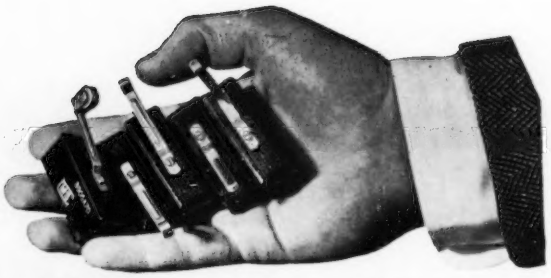
We design_____

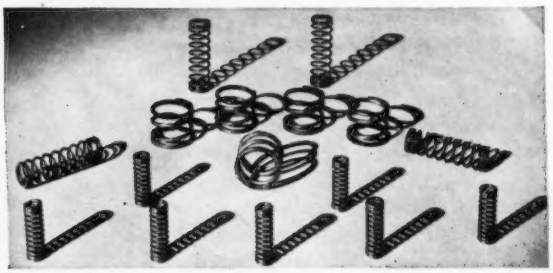
Name_____

Company_____

Street_____

City_____ Zone____ State_____





High tensile strength

Armco 17-7 PH wire, when hardened, exhibits elastic properties like those of the best music wire and alloy spring steels. For the odd shapes required in applications such as switch actuators (upper photo), as well as conventional coil-type springs (lower photo), Armco 17-7 PH can be cold formed without breaking. Its remarkable mechanical properties are then developed with heat treatment at 900 F for 30 minutes.

Good corrosion resistance

Armco 17-7 PH can be hardened to spring temper, yet it retains its good corrosion resistance. The two saws (above) were left on the ground side by side for 30 days. Corroded "Exhibit A" is ordinary carbon steel. The bright, rust-free "Exhibit B" is Armco 17-7 PH.

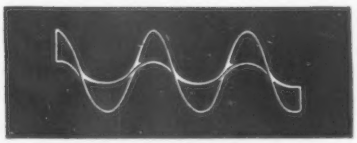
High spring quality and the excellent corrosion resistance of 17-7 PH also make it highly desirable for soil working shapes, such as discs and shovels.

For complete information on these special Armco Stainless Steels, just fill in the coupon and mail it to us.

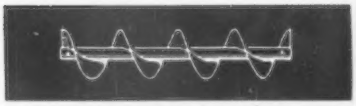
ARMCO STEEL CORPORATION
2576 CURTIS STREET, MIDDLETOWN, OHIO
SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC., THE ARMCO INTERNATIONAL CORPORATION

Flexible in application . . . versatile in operation

Link-Belt augers simplify design

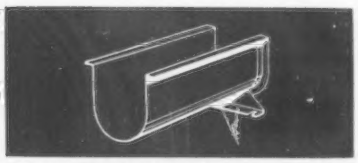


SELECTED FLIGHTING for all your auger needs. Helicoid, sectional or a range of other types of flighting are available in the metal and finish best suited for your design.



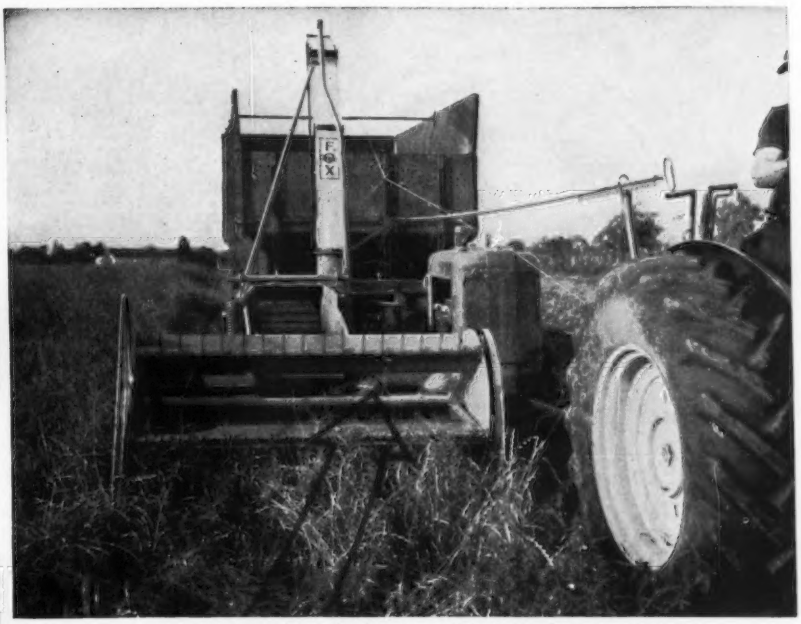
SIMPLICITY OF CONSTRUCTION and sturdy design of Link-Belt augers provide dependable, efficient operation on your machine. One basic assembly with no other moving parts to break down.

YOUR CHOICE OF METALS answers your requirements for handling corrosive or abrasive materials. And Link-Belt uses only specially selected steels to assure a uniform product.



ALL COMPONENTS — conveyor screws, collars, couplings, hangers, troughs, trough ends, flanges, drives —are available for every design.

ENGINEERING SERVICES. Our auger specialists will help you analyze your special needs . . . integrate all elements of your design.



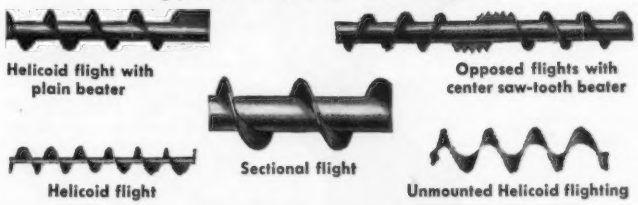
LINK-BELT AUGER helps this Fox heavy-duty forage harvester convert standing green hay into silage ready for silo or dehydrator in one operation. Auger represents one of many types designed and built by Link-Belt for modern farm implements.

You can be sure of efficient operation, long life and low maintenance when you make a Link-Belt auger part of your equipment.

Link-Belt has a wide selection of augers, many of a specialized design, in a full range of diameters, gauges and pitches. They're accurately made to assure easy assembly, smooth, dependable operation. In addition, all components can be adapted to your particular design.

Whether it's a new application for your present machines or an entirely new concept, simplify your design problems by specifying Link-Belt augers. Call your nearest Link-Belt office for complete information.

Typical LINK-BELT augers



Write for LINK-BELT Screw Conveyor Book 2289

LINK-BELT

FARM MACHINE AUGERS

14,460

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

For more facts circle No. 45 on reply card

Under operating pressures bushing heats and releases stored lubricant which is reabsorbed by bushing when chain is idle. Cycle continues for life of chain.

SETTING NEW STANDARDS

Whitney engineering has developed and proven by extensive field service an exclusive and revolutionary Self-Lubricating SINTERED STEEL BUSHING that brings entirely new concepts in agricultural chain. Whitney's SELF-LUBE Ag Chain keeps farm equipment *continuously operating* without chain maintenance. It will outlast regular chain by as much as 5 to 1 when subject to rugged field service in atmospheres laden with dirt or moisture.

Whitney's Sintered Steel Bushings are PRELUBRICATED FOR LIFE, "oil from the *inside*", lubrication is unique, being *in ratio to load* . . . the tougher the job, the greater the lubrication. When idle, the Whitney bushings reabsorb surfaced oil. Further, the chain design itself provides controlled side-plate clearance, cannot trap abrasive foreign matter that ordinarily cuts chain life . . . making this "the chain that maintains itself."

And Whitney Self-Lube Ag Chain is completely INTERCHANGEABLE with A.S.A. Double Pitch Roller Chain . . . presents no replacement problems. They are precision made of premium materials and engineered for all types of farm equipment. This Whitney Chain development will contribute to your product reputation by providing new service benefits to your customers.

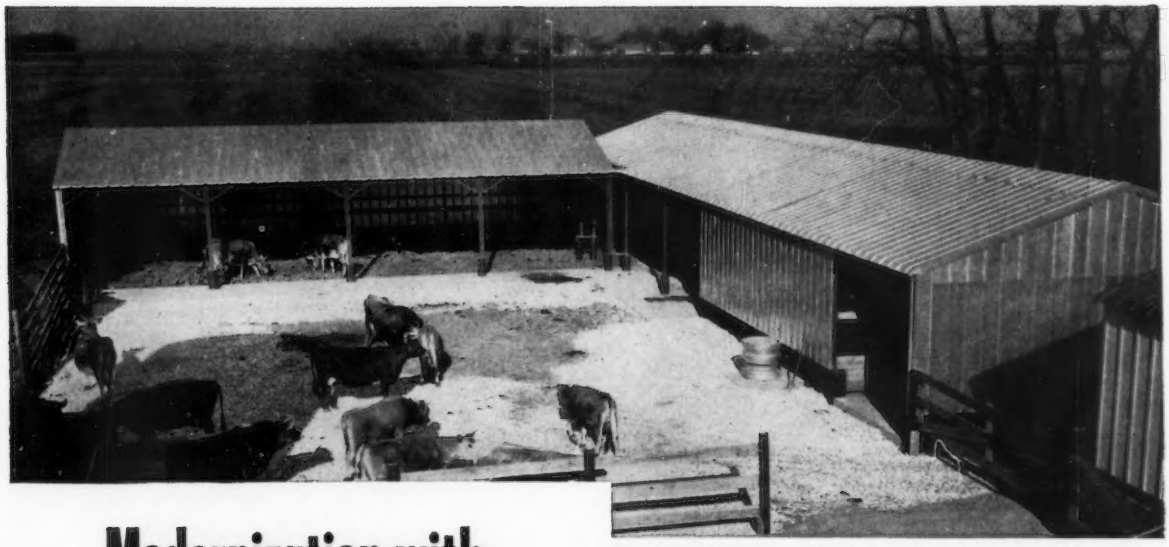
Write for complete information and literature.

Whitney

CHAIN COMPANY

246 HAMILTON ST., HARTFORD 2, CONN.

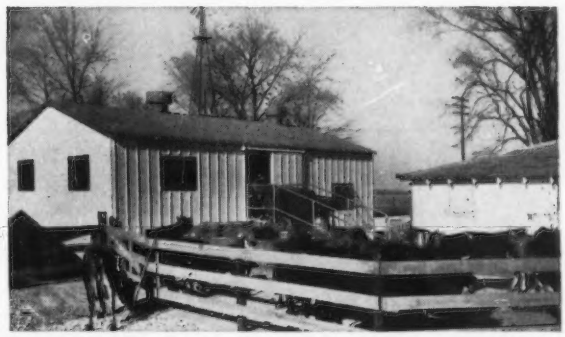
SELF-LUBRICATING • SELF-CLEANING • HIGH STRENGTH • COMPLETELY INTERCHANGEABLE



The above laborsaving arrangement of steel buildings illustrates the bedded loafing area on the left. The building on the right houses a hay and straw storage area with a self-feeding manger.

Modernization with Factory Built Steel Buildings

pays off handsomely for dairy farmer Ross Griffith of Galesburg, Ill.



Combination Milking Parlor—Milk House Building: contains a three-stall "U"-type milking parlor and a roomy, well-ventilated milk room. In addition to the above three buildings, the Griffith farm has a Factory-Built machinery storage building.

By installing Factory-Built Steel buildings for a loose housing system, Mr. Griffith has changed from a Grade C to a Grade A dairy operation—and now in less chore time than he formerly spent, he can handle twice as many of his registered Jerseys.

The use of versatile steel buildings, fabricated from USS Galvanized Steel Sheets with USS Structural Steel framework, makes this economic, time-saving operation possible. The clear span construction permits the use of mechanical equipment for manure and hay handling. Hay and silage are self-fed and concentrates are fed from hoppers in the insulated steel milking parlor.

See The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

WHEN YOU WISH TO MODERNIZE AND ACHIEVE THE SAME PAYOFF, THEN

SEND THIS COUPON FOR FURTHER INFORMATION

Agricultural Extension
United States Steel Corporation
Room 5576, 525 William Penn Place
Pittsburgh 30, Pa.

I am interested in steel buildings for the following:

☐ *dairy barns* ☐ *hay storage* ☐ *machinery storage*
☐ *cattle shelters* ☐ *grain storage* ☐ *poultry houses*

☐ *other* .....

Approximate size or capacity .....

Send information to:

Name .....

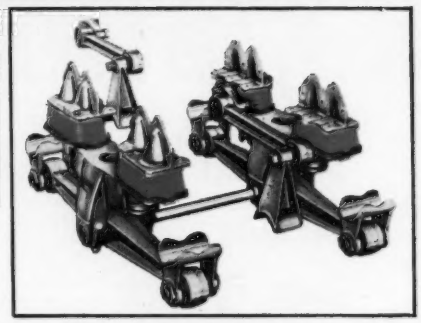
Address ..... **Town**.....

County ..... **State**.....

United States Steel Corporation produces high-quality USS Galvanized Steel Sheets and Structural Steel which our customers manufacture into durable farm buildings. Your request for information will be forwarded to the manufacturers of these buildings, and you will hear directly from them.

UNITED STATES STEEL

For more facts circle No. 9 on reply card



The unique design of the "load cushion" accounts for smooth, even rides in the full range of loads, empty to full. Enjay Butyl Rubber (in red) made it possible.

ENJAY BUTYL "LOAD CUSHION"

replaces steel springs in big Tractor Trailers

The "load cushion" is an important innovation in tandem suspension. Developed by the Hendrickson Mfg. Company, it is made of Enjay Butyl and replaces steel leaf springs. Utilizing the great strength and impact resistance of Enjay Butyl, the "load cushion" gives the ultimate in a soft, easy ride within the complete range of loading, from empty to full. Besides giving a smoother, steadier ride, it increases tire mileage, reduces weight and significantly reduces wear and tear on equipment.

Enjay Butyl has proved to be the answer to problems in many fields of industry. It may well be able to cut costs and improve the performance of *your* product. Low-priced and immediately available, Enjay Butyl may be obtained in non-staining grades for white and light-colored applications. Get all the facts by contacting the Enjay Company. Complete laboratory facilities and technical assistance are at your service.

ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY

Pioneer in Petrochemicals

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WHERE POWER STEERING REALLY COUNTS

—making the job easier for the man who rides a tractor

Power steering is every bit as desirable for farm tractors as it is for passenger cars—*and for more and better reasons.*

By taking the tiresome muscle work out of steering, it makes tractor work not only an easier task but a far more efficient operation.

For example, power steering eliminates wheel fight and shock even over the roughest ground; it holds the wheel firmly against the furrow when plowing; it permits the tractor to be controlled by simply "pointing" where the driver wants it to go.

Also, short turns become an easy, one-hand job even when the tractor is standing still.

Any way you look at it, power steering saves time as well as work, and that's exactly why power steering on farm tractors is destined to be the next step forward in farming efficiency.

Bendix* Power Steering is a performance-proven product designed and engineered by Bendix, foremost producer of power steering and brakes for the automotive industry.

It is used with a conventional steering gear and is adaptable to existing steering linkage, permitting tractor manufacturers to make production-line installations without costly or extensive engineering changes.

Manufacturers interested in adding Bendix Power Steering to their present list of sales features are invited to write for further details to BENDIX PRODUCTS DIVISION, SOUTH BEND, INDIANA. *REG. U. S. PAT. OFF.

Export Sales and Service:
Bendix International Division,
205 East 42nd Street, New York 17, N. Y.

Bendix PRODUCTS DIVISION South Bend IND.

Bendix AVIATION CORPORATION

For more facts circle No. 46 on reply card

Why risk designing-in oil seals yourself?

National's teams of veteran sealing engineers are constantly at your service!

Oil seals are precision products. They are designed to operate under specific conditions. Change just one of these conditions—lubricant, shaft speed, temperature, even position of the bearing—and a different seal will almost always be needed.

Why chance costly retooling or remanufacture—or operating failure in the field. National Seal engineers provide the world's most complete technical help on seals. Be sure seals you use are exactly right. Call your National Seal engineer today—in major cities nation-wide.

NATIONAL SEAL
DIVISION, Federal-Mogul-Bower Bearings, Inc.
GENERAL OFFICES: Redwood City, California
PLANTS: Van Wert, Ohio and Redwood City, California

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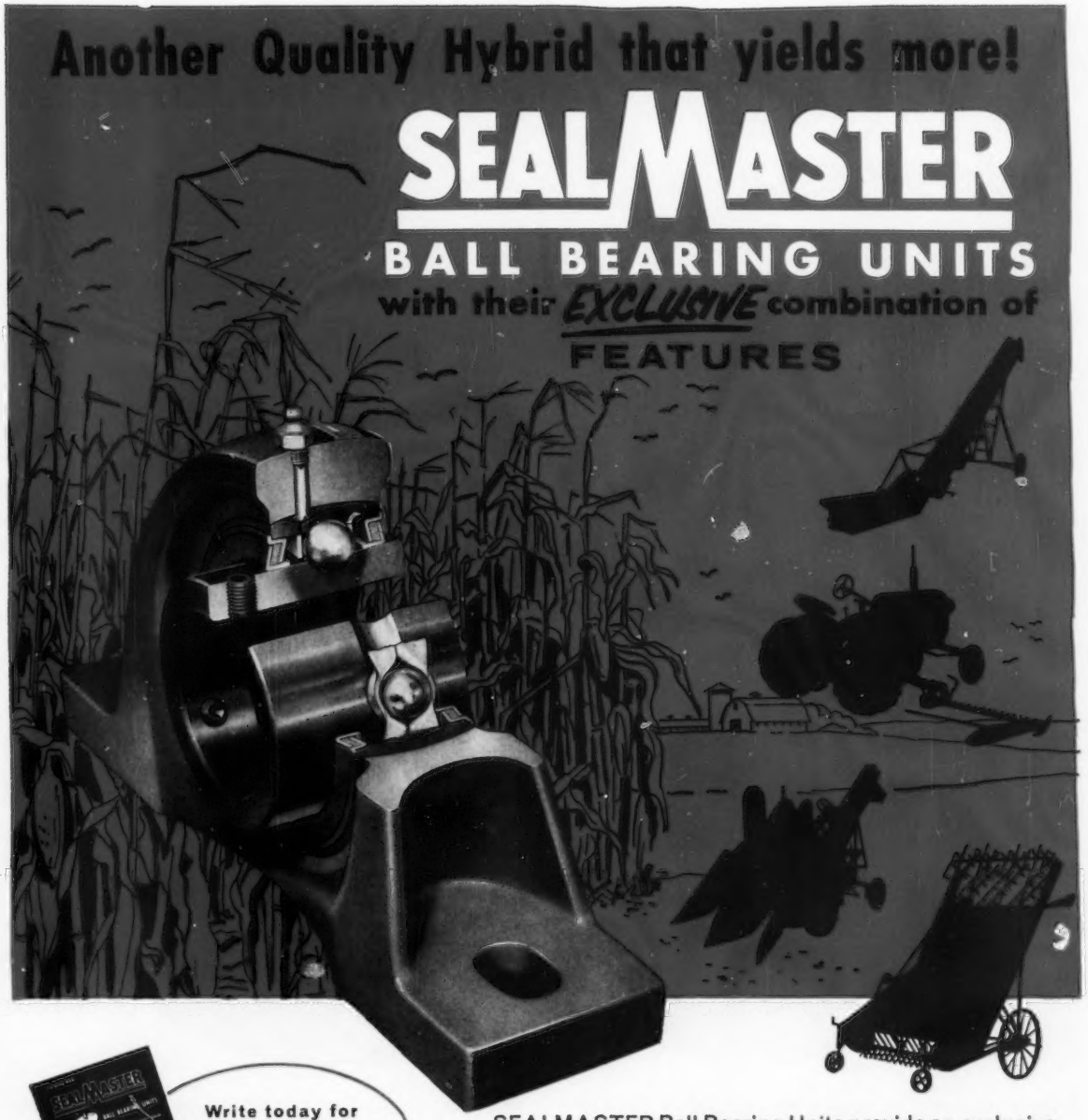
Another Quality Hybrid that yields more!

SEALMASTER

BALL BEARING UNITS

with their *EXCLUSIVE* combination of

FEATURES



Write today for your Free copy of **SEALMASTER** Catalog 454.

SEALMASTER Ball Bearing Units provide an exclusive combination of features designed to provide higher standards of bearing performance and longer bearing life. They are based on sound engineering and rigid laboratory and field tests. They are important to the dependable operation of the farm machinery you build or sell. We will be happy to send you full information or have a SEALMASTER factory representative or stocking distributor call on you. It's quality you can't afford to overlook!

SEALMASTER

BALL BEARING UNITS

SEALMASTER BEARINGS, A DIVISION OF STEPHENS-ADAMSON MFG. CO., RIDGEWAY AVENUE, AURORA, ILL.

For more facts circle No. 50 on reply card

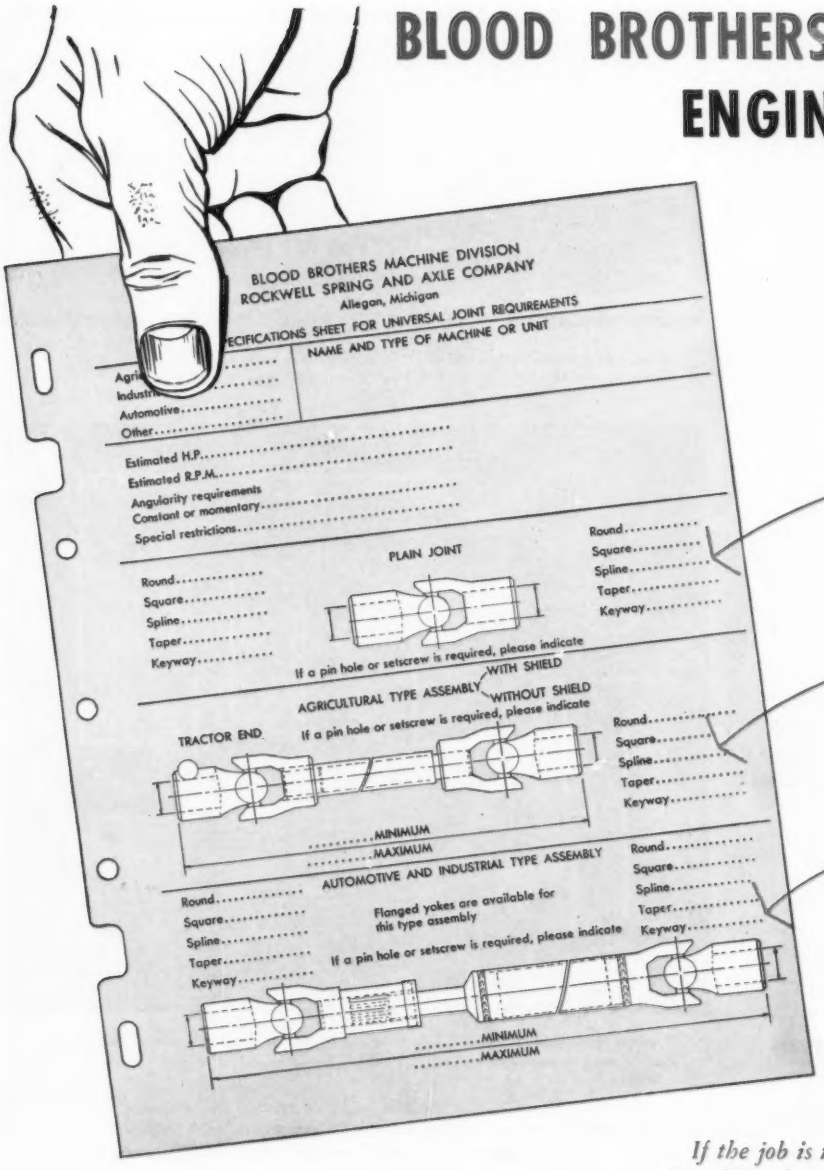
A choice of round or square bores in Fafnir Tri-Ply-Seal Ball Bearings permits disc implement manufacturers to equip for reduced bearing maintenance and wear — and lower production costs — regardless of the type of shaft used.

Constructed with integral Tri-Ply-Seals, these Fafnir Bearings provide positive protection against dirt and moisture. They are pre-packed with long-life lubricant which never needs to be replaced . . . saving farmers costly maintenance time, trouble, and expense. They cut production costs by eliminating the need for cartridge-type housing seals . . . make possible simpler, more compact mountings.

Fafnir Tri-Ply-Seal Ball Bearings are available in self-aligning and rigid types to meet all housing requirements. Built to stand up under punishing loads, they have shock-resistant rings, large-size balls, deep races, and extra width for greater shaft support. Write for bulletin showing typical applications and complete specifications. The Fafnir Bearing Company, New Britain, Connecticut.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

BLOOD BROTHERS makes your ENGINEERING JOB *EASIER*



. . . regardless of whether your project requires a single universal joint such as this

. . . a complete agricultural type assembly

. . . or an automotive or industrial truck propeller shaft like this

Just fill out and mail a sheet like *THIS*—and let BLOOD BROTHERS' Engineers propose a helpful, practical solution to your Drive Line Problem!

If the job is unusual or the problem unique, Blood Brothers' experience can be invaluable.

Many engineers are saving valuable time—right at the start of a project—by filling out and returning a "Spec Sheet" like this to Blood Brothers. Why not try it?

With your power transmission requirements in mind, our engineers will make recommendations and submit engineering drawings. You save designing and drafting time, and perhaps forestall problems, by having the initial teamwork of experienced specialists.

This service is offered without extra charge because *we* can work more efficiently with all the facts in hand.

Blood Brothers builds *more standard types and sizes* of universal joints than any other manufacturer (from 300 up to 89,300 torque inch pounds continuous load).

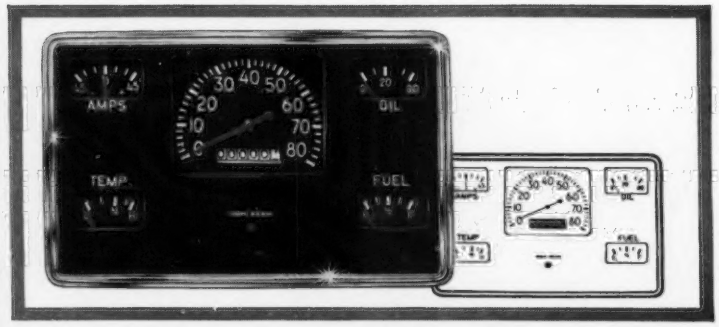
Why not use this experience on your next project? *Write Blood Brothers today for your handy "Spec Sheets."*

BLOOD BROTHERS MACHINE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
ALLEGAN, MICHIGAN

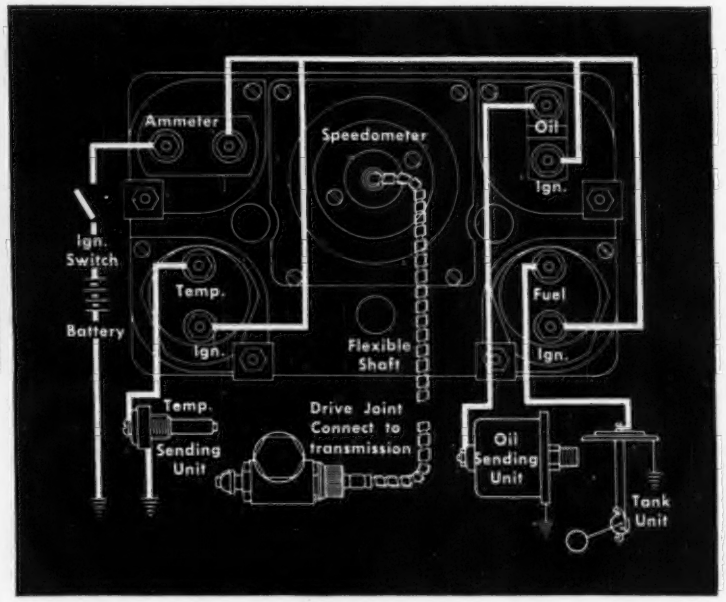
UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

For more facts circle No. 63 on reply card

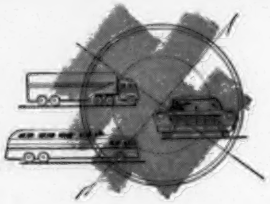
How STEWART-WARNER can help you plan a complete INSTRUMENT PANEL



Stewart-Warner Panel 602-H. A stock panel now used by leading truck manufacturers. Highly flexible—can be fully electric or combination of electric and mechanical.



Typical Hook-up for Panel 602-H. Above panel includes mechanical speedometer, electric gauges, complete with sending units.



. . . from designs to finished panels . . . custom-made or stock models —for cars, trucks, buses and engines!

At every step of design—from styling of panel to choosing drive equipment—Stewart-Warner offers you the widest selection . . . plus engineering teamwork unmatched by any other manufacturer!

Stewart-Warner furnishes the most complete line of individual instruments—speedometers, tachometers, tachourmeters—and gauges of all types. Our engineers will help you combine these in one of our many standard panels . . . or an entire panel can be custom-made to your specifications.

Stewart-Warner—instrument specialists for over half a century—can supply all your instrument needs and drive equipment *from one dependable manufacturing source.* Save money by consulting Stewart-Warner now. . . while your designs are still in the early planning stage and are subject to modification!

For further information, write:

STEWART-WARNER

Dept. KK-27, Original Equipment Sales
1840 Diversey Parkway • Chicago 14, Illinois

Cat No. 12 Motor Grader building diversion terraces to prevent soil erosion. This rugged heavy-duty machine wins farm power contractors many friends. It quickly and efficiently builds solidly constructed, accurately graded terraces.

A Cat D318 Engine Powers this Dragline shown cleaning out a drainage canal. It pays to specify Caterpillar Diesel Engines for construction equipment. They more than pay for themselves by added efficiency, economy and long life.

Standardize on Caterpillar Equipment!

All of the machines pictured here have one thing in common: *they are all powered by the same dependable CAT* Diesel Engine!* Think what this means to the earthmoving and land clearing contractor who standardizes on Caterpillar-built equipment: he stocks fewer parts, simplifies his operator training program, and best of all, selects the best there is in construction equipment. He concentrates responsibility for top-notch performance at one point—with his Caterpillar Dealer and with Caterpillar Tractor Co.

Sticking with the Caterpillar family pays off in greater production, lower costs, more profits. There are more than 100 different machines in the Caterpillar family to choose from. Your Caterpillar Dealer will help you select the equipment you need. See him soon.

CATERPILLAR TRACTOR CO., Peoria, Illinois, U.S.A.

CATERPILLAR*

* Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Track-type Tractors up to 260 DBHP
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Agricultural Engineering

February, 1957
Volume 38
Number 2

James Basselman, *Editor*

Keeping Quality High . . .

THE editor and members of the ASAE headquarters staff acknowledge and thank all those who have written in or otherwise announced their approval of the "New Look" introduced in the January issue of AGRICULTURAL ENGINEERING. The response has been most gratifying and the return of business-reply cards has exceeded all expectations. Time and space will not permit publishing all the kind things that have been said.

Most of the new features in the Journal are of a visible nature and easily discerned. However, one important behind-the-scenes change in editorial policy easily could go unnoticed. This new change is a policy for evaluating technical papers before they are published. Each technical division steering committee of ASAE has been asked to submit to the editor a list of critical readers to appraise manuscripts. Each critical reader is considered a recognized authority in his field. A card file of critical readers, listed according to specialty, is being set up and will be maintained by the editor. When a paper is submitted for publication the editor sends a copy to two readers for recommendations and suggestions for improvement.

The plan has been set up to assist the editor in selecting articles and to improve the quality of papers being published. In operation, an author submits his paper for publication in triplicate. From the file of critical readers, the editor selects two readers to whom copies of the paper will be sent for evaluation. Each reader is asked to fill out a questionnaire prepared to provide the editor with sufficient information about the paper, so that he in turn can compare a paper with others on the same subject.

The questionnaire permits the critical reader to express his opinion, to make recommendations regarding publishing, and to offer suggestions for improvement. It also provides a degree of uniformity in grading. When two readers agree that the paper is worthy of publication, with minor or no modifications, the paper is scheduled for publication in accordance with space, makeup, timeliness, technical matter distribution and other editorial considerations.

In cases where critical readers disagree, a third reader is consulted and majority opinion rules. If a reader suggests that a paper should be revised before publication, he may make comments and suggestions for improvement. The editor returns the paper to the author with the readers' suggestions. The author may revise the paper to the readers' satisfaction or withdraw it from publication.

Reasons for rejection of any paper will be sent to the author. If the author feels that the critical readers have been unfair he may ask for new evaluation by other readers. A paper may be rejected on the grounds of insufficient technical matter, duplication of other published material, or simply that it does not meet the standards or objectives prescribed for publication in the Journal.

All manuscripts not accepted for publication in complete form may be abstracted for the Technical Paper Abstract column in AGRICULTURAL ENGINEERING, if agreeable to the author, and mimeographed copies made available for distribution upon request.

Critical readers remain anonymous to permit rendering advice freely without personal embarrassment.

The new readers group plan is similar to systems used by many other engineering societies and promises to render a valuable service to ASAE by keeping the published articles at a high quality.

Suggestions to Authors . . .

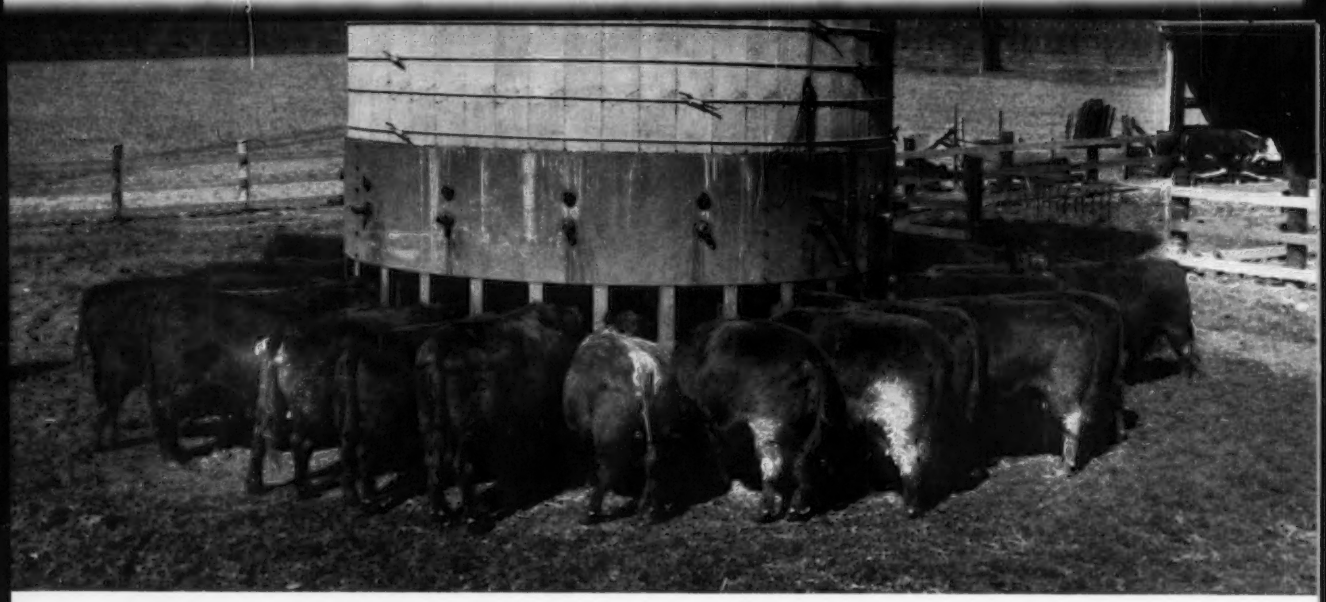
REPORTS from other societies have stressed the fact that most papers can be improved by condensation. Critical readers will be asked to put particular emphasis on the length of the paper and the elimination of any extraneous material. The author can save much time and improve his chances for getting his paper published by critically examining his manuscript to determine whether he has devoted too much space to description of preliminary investigations, too lengthy descriptions of known practices, history, legislation or procedure. Care in this regard encourages wider reading and the saving in editorial space permits ASAE to publish more papers.

Illustrations should be essential and in proper form. Graphs and line drawings should be about 8½ by 11 inches, or larger, and should be drawn with India ink on tracing cloth or white paper. Do not use color. All lettering in the drawing should be large enough to be legible after reduction. A simple rule to remember is to keep the height of lettering not less than 1/45th of the width of the drawing. Keep in mind that many drawings are reduced to one-third in size. Fine detail and all but major coordinates should be avoided. Do not include the titles of graphs within the figure. They are set in type in the captions.

Photographs are especially useful in illustrating an article and add considerably to its effectiveness, but they should be kept to a minimum. Clear, glossy, black and white, unmounted prints should be used. Negatives are not required.

Equations should be distinct and readable. Indistinct figures make it impossible to edit equations correctly. This necessitates many changes when the author corrects his proof and results in an unnecessary increase in printing costs.

In the near future an editorial manual will be prepared in which a complete guide for authors will be included.



Self-Feeder Silo Controls Silage Flow

Combining a new principle, which he recognized, with an old one, the author has succeeded in designing a self-feeder base for a vertical silo that successfully controls the downward movement of a supported mass of silage within the silo

MARK E. SINGLEY
Assoc. Member ASAE

A NEW principle of silage manipulation has evolved as a result of research work on self-feeder vertical silos conducted at the New Jersey Agricultural Experiment Station. Several theories pertaining to silage and hay manipulation have been published. Usually they deal with the response of the chopped material when placed in tension and with methods of altering this response. The material is placed in tension when the cone, which is usually used with upright self-feeder structures, begins to penetrate the horizontally laminated chopped material. Reed (1)* demonstrated that due to its high tensile strength, silage would not flow over a cone. He listed some of the methods tried by himself and others to cause the silage to separate and flow over a cone. In one of his silos he positioned a stationary, horizontal sharp knife to cut the material vertically. This did not prove to be satisfactory. Mazur of Fiddlers Creek Farm used a movable partition during the filling operation to divide the silage and create a permanent cleavage plane. This method was satisfactory and is still used by him for silage, and by others for hay(2). Engineers of the A. O. Smith Corporation used a central column to eliminate the need for the cone to punch through the silage. This did not help materially.

Paper presented at the annual meeting of the American Society of Agricultural Engineers at Roanoke, Va., June, 1956, on a program arranged by the Farm Structures Division. Approved paper of the Journal series, agricultural engineering department, New Jersey Agricultural Experiment Station.

The author—MARK E. SINGLEY—is associate professor of agricultural engineering, New Jersey Agricultural Experiment Station.

*Numbers in parentheses refer to the appended references.

More recently further observations have been made, with the result that a new principle has been recognized.

Silage as a mass is a fibrous material. Within a silo all the fibers lay in the horizontal plane. In the vertical plane they have random positions. If any horizontal axis is chosen as a basis for comparison with the most common fibrous material, namely, a cotton thread, it is possible to begin analyzing the response of the silage. When placed in tension axially, those silage fibers laying along the axis of study contribute strength; those at right angles, no strength, and those at intermediate angles, intermediate strengths.

A cotton thread, which is composed of unidirectional fibers, has its desirable strength characteristics only when placed in tension. The more tension applied, the more the individual fibers grasp each other and contribute to the total strength. Fibers in threads are nearly always placed in tension; however, if placed in compression axially, the individual fibers are released from each other and the thread loses its strength. Silage responds in the same way. When placed in tension, it has high strength, but when placed in compression, the fibers separate and the material fails easily. If a suspended mass of the material is restrained from expanding upward by weight above, and is compressed on the sides, the mass will expand downward in the unrestrained direction and the fibers will separate and balloon out.

This principle was applied to the design of the latest self-feeder silo base at the New Jersey station. Around the inside of the bottom of the cylindrical silo, over the feeding area, are located fixed baffles that extend into the silo. They

are not continuous. When the silage is partially supported by them, and at regulated intervals allowed to move over them, the silage is compressed radially to adjust to the reduced diameter and circumferentially to adjust to the shorter circumference (Figs. 1 and 3).

When the silage is suspended on peripheral supports and compressed radially, it is free to expand in only one direction, downward, and the middle portion fractures and drops out. The weight of the unsupported silage in the middle encourages this action. In addition, the mass is poised like a giant spring differentially loaded with height, because it is an elastic material and is compressed during silo filling. With peripheral support, the middle is free to relieve its compression and balloon downward.

When compressed circumferentially, it is free to expand downward and outward between the baffles. Ballooning occurs and ragged radial fracture planes are created. This separates the silage on the baffles into segments for individual manipulation.

Since the baffles are fixed, they can only supply partial support. Sufficient additional support to keep the material suspended is provided by means of sliding or rotating pins. Complete support is then provided by fixed members and removable ones. The fixed members must be designed carefully so that they will provide a maximum of uniformly distributed support and yet not completely support the material. A uniformly distributed support that is always maintained is most desirable for the successful design of the structure and manipulation of a mass as large as 150 tons or more (Fig. 2).

Since each individual baffle and pin combination supports a segment of material, it is subjected to localized vertical compression. Being an elastic material as well as a fibrous one, the silage will extend the vertical compressive forces outward horizontally in an approximate V shape (Fig. 4). This means that material beyond the compressed region will try to maintain its original condition. This too results in the fracture and separation of the material between the peripheral points of support.

Fractures created within the material are the result of forces of gravity, intermittent vertical compression, and the new principal—horizontal compression. These fractures are very desirable for the manipulation of the silage.

A sectional view of the silo base through the diameter is shown in Fig. 2. It is evident from this figure that the cone still punches through the material but it occurs above the area of manipulation. This is done by elevating the tip of the cone by means of a stub center column. The conical cap on the top of the stub center column overhangs the column several inches. The resistance offered by the cap is insufficient to prevent the downward movement of the silage. Once past the cap all resistance is removed since the material can only try to assume its original shape. Once worked, the material never completely returns to its original shape.

The stub center column is used to prevent material from resting on the cone proper. If it does, the material becomes so dense that the cattle cannot consume it. When filling is initiated, the pins are inserted through the silo walls. After the silo has been filled to the elevation of the cap of the stub column the pins, baffles, and stub column accept the weight of the material deposited above them. The silage below remains loose and will retain its quality if the

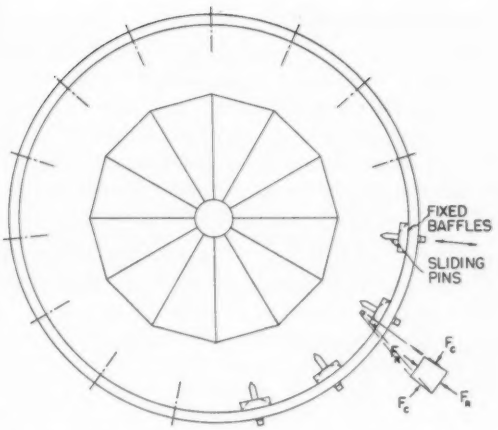


Fig. 1 Circumferential and radial compressive forces are shown on an enlarged increment of silage projected from the area adjacent to the fixed baffles.

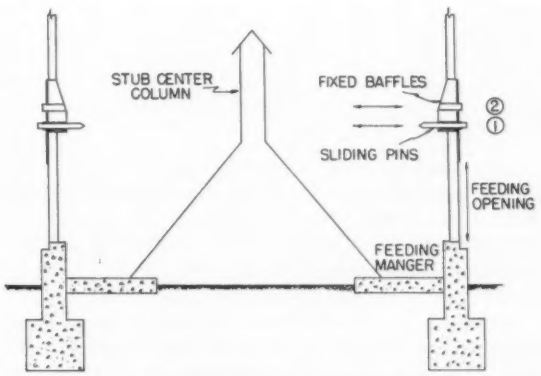


Fig. 2 *(Above)* A sectional view of the silo base showing the arrangement of stub center column, fixed baffles and sliding pins. During pin operation, they are withdrawn from location 1 inserted at location 2 and withdrawn to be reinserted at location 1

Fig. 3 *(Below)* Within the self-feeder base of the silo, fixed baffles are located immediately below the elevated support for an upright silo

. . . Self-Feeder Silo

base closure is airtight. A plastic film wrapped around the silo base over the feeding openings and bonded to the steel on top and to the concrete on the bottom creates an airtight seal.

After the silage within the base has been consumed, the remainder is suspended and manipulation is required to control the descent of this material. Two sleeves, one 8 in above the other, extend from each baffle through the side of the base. A pin fits either of these sleeves. The sequence of an individual pin's operation is as follows: Initially the pin is inserted through the bottom sleeve, at (1) Fig. 2. The support it provides is removed by withdrawing the pin. A hydraulic cylinder, control valve, and pump assembly with an appropriate cylinder-pin connection and support is used to withdraw the pins. The segment of silage that is contained vertically between the pin and the bottom edge of the inclined portion of the baffle will expand and is now free to drop. Usually it will not drop immediately and sometimes not at all. To drop it, the pin is then inserted in the top sleeve and pushed in hydraulically at (2), Fig. 2. This pushes the segment off the baffle, and it drops into the feeding manger below. The pin is then withdrawn and reinserted in the bottom sleeve to accept a load again when the silage settles down on it. Several pins are operated before the silage will slip past the baffles and come to rest on the pins again. The amount of silage dropped, also the location of the drop, is controlled by the number and location of the pins manipulated.

The silage is not all consumed from the manger. Some of it is suspended within reach of the cattle, and wherever silage hangs loosely the cattle will consume it. This is a large amount. Some animals prefer to reach up and pull down their silage, while others prefer to feed from the manger.

The lower pin described above provides an on-off action. It either supports material or is withdrawn and frees the material. The hydraulic power required to accomplish this is used from outside the silo. The silage contains a large amount of potential energy. Part of it can be used to actuate an on-off mechanism inside the silo. Fig. 5 illustrates a simple device that is restrained by an on-center restraining arm free to rotate. When the frictional forces are overcome and the arm is moved off center, the weight on the rotating pin moves the arm downward out of contact with the rotating pin. The pin then can rotate clear and the material is freed and usually drops into the feeding manger below. A hand-operated handle attached to the restraining arm provides enough leverage to move the arm off center.

Approximately 5 min are required to complete the sequence of pin operations at each pin baffle location using the hydraulic cylinder, while less than a minute is required to operate the rotating-pin mechanism.

During the 1955-56 winter feeding season, a 14 x 40-ft concrete-stave self-feeder silo fitted with three rotating pin assemblies and 12 hydraulically operated pins required 26½ man-hours of labor to empty it. This silo is located on the New Jersey Agricultural Experiment Station farm. A brood cow herd of 40 cows and a number of calves fed from the silo between November 10 and March 1; it contained approximately 160 tons of sorghum and soybean silage. In addition to the silage, the cows had access to hay.

On the average, manipulation of the pins was required every 2 days. During freezing weather, pins were often operated every day. When the silage was not frozen, pins sometimes did not require operation for as long as 4 days. For this silo, 30 min time was required for each manipulation and usually six of the 15 pin locations were used.

For 15 pin locations, the silo is supported on 30 columns and this provides 30 feeding openings. The feeding circumference is 47 ft. The feed manger was allowed to be completely emptied only once; however, each time silage was dropped, as many as 30 cows fed simultaneously. They always gathered to feed when the person operating the silo approached, and it was inspected daily.

A total of six self-feeder silos are being studied experimentally. In these, different forages have been stored and self-fed. Properties of the ensiled materials vary considerably. Ensiled cereal grains flow most easily and are most difficult to support. Orchard grass silage flows next easily, then corn, sorghum and soybeans, alfalfa, and finally the clovers.

In summary, a new principle combined with an old one has been used to design a self-feeder silo base that will successfully control the downward movement of a supported silage mass. To empty a 14x40-ft silo during the past winter-feeding period, 26½ man-hours of labor were required.

(Continued on page 93)

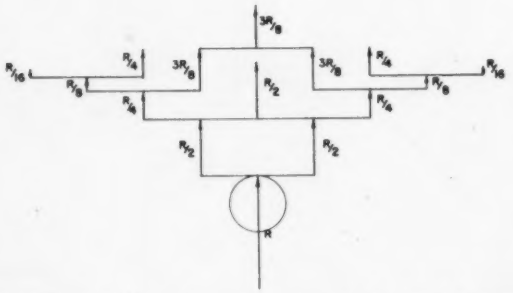


Fig. 4 Vertical compressive reaction on a pin is extended outward horizontally

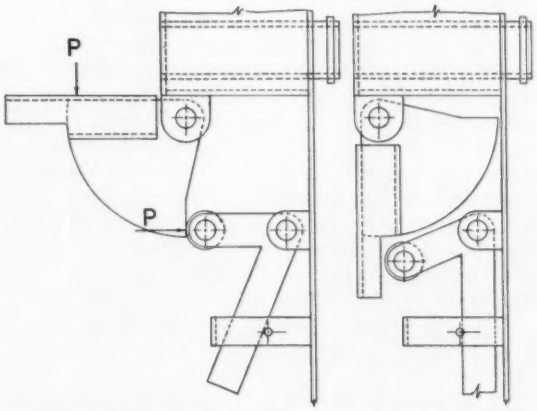


Fig. 5 The sliding pins have been replaced by a simple on-off device called a rotating pin. When the frictional forces are overcome and the arm moved off center, force *P* moves the arm downward out of contact with the rotating pin and the pin rotates clear of the silage

Anchorage of Buildings with Fluted Nails

E. George Stern

The anchoring of framed structures to concrete foundations has become considerably simplified with the introduction of the fluted masonry nail, which does away with the necessity of bolts for this purpose

ANCHORAGE of framed structures has recently been the subject of numerous discussions with the advent of particularly light construction systems, the use of flat-pitched roofs with wide overhangs, the introduction of large wall openings for windows and doors, the construction of buildings in highly exposed areas, the relatively frequent occurrence of seismic disturbances, hurricanes, and tornados in lightly as well as heavily populated regions, and the potential exposure of our structures to atomic and nuclear blasts.

The recommendation is being advanced that all framed structures should be anchored to their foundations, except when it is shown that such anchorage is not necessary because of the internal resistance of the structure to uplift and lateral movement.

Such a recommendation is justified in light of recent developments which make it possible to anchor framed structures to the foundation effectively and efficiently with a minimum of effort and expense.

Conventional anchorage consists of embedding of ½-in-diam steel bolts in the foundation and fastening the mudsill with washer and nut to the protruding anchor bolt. This procedure is relatively time-consuming, hence costly. If consideration is given to the fact that more than one million dwelling houses, in addition to the numerous farm structures, are erected in this country during a single year, the cost of such anchorage is an economic factor of certain importance.

A somewhat more recent method of anchoring buildings to foundations is that of driving powder-actuated steel fasteners with a gun-like device through the lumber into the foundation. This anchoring procedure proved to be successful, insofar as satisfactory anchorage can be provided with a minimum of effort any time during construction independent of the construction progress. On the other hand, the initial cost of the tool and the cost of the fasteners and powder charge required for every fastener application have, in most cases, been a deterrent to the farmer to use this means of anchorage, despite the advantages and conveniences afforded by it.

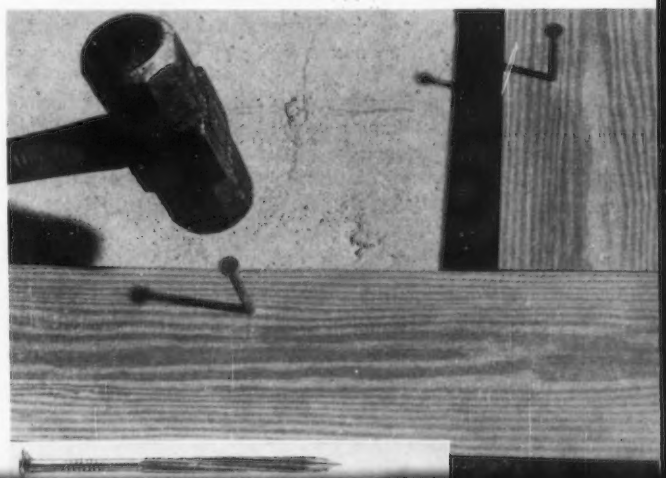
In order to make available a possibly more economical method of anchoring framed structures to foundations—a method which does not require a special tool—considerable research work was performed to develop a nail which can be driven into concrete with a heavy hammer. These studies have resulted in developing hardened (heat-treated and oil-tempered) high-carbon-steel fluted masonry nails of light or heavy-duty type, with large diameter, flat, checkered, and slightly countersunk heads and medium diamond or needle points.

The light 2¾ x 0.148-in nails are used for fastening load-bearing and non-bearing exterior and interior- partition sills as well as sleepers to concrete floors, slabs, and footings under average field conditions. The heavy-duty, 3½ x 0.250-in nails are especially suitable for anchoring farm structures. They were accepted for fastening bearing and non-bearing interior partitions in earthquake-exposed regions by the Pacific Coast Building Officials Conference during October, 1955. As additional design information has been made available since that time, these heavy-duty nails appear to be suitable also for fastening 2x6 mudsills of exterior load-bearing and non-bearing frame walls in these danger regions.

The results of tests on the light masonry nails indicate that their axial withdrawal resistance amounts to 344 lb immediately after being driven through nominal 2 x 4-in

(Continued on page 93)

Fig. 1 Nailing 2 x 6-in mudsills to concrete slab with heavy-duty 3½ x 0.250-in hardened, high-carbon-steel, fluted nails. A 6-lb hammer is used for driving. *(Inset)* Light and heavy-duty fluted masonry nails



Paper presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1956, on a program arranged by the Farm Structures Division. The paper reports results of an investigation conducted at the wood research laboratory of the Virginia Polytechnic Institute under the sponsorship of the Independent Nail and Packing Co. Further information is available in VPI wood research laboratory bulletins Nos. 20 and 23.

The author—E. GEORGE STERN—is research professor of wood construction, engineering experiment station, Virginia Polytechnic Institute.

New Principle in Tractor Hitch Design

Operation features of a new hitch, designed to obtain uniform results in fields of varying soil conditions and uneven contour (with less operator attention), are described in detail. The authors offer the new development as a guide toward still further improvement in a most important phase of farm equipment design

E. W. Tanquary and A. W. Clyde
Fellow ASAE Life Fellow ASAE

DURING the past few years, hitches for rear mounted implements have been developed for practically all models of farm tractors. Hitches of this type do present distinct advantages in the saving of time and reduction in physical effort when changing from one implement to another. Probably of even greater advantage is the ability to detach the implement complete with field adjustment preserved intact so that it can be reattached as a unit without readjustment.

Introduction of power adjusted wheels to facilitate changing rear wheel treads, is another important step toward reduction of the non-productive effort involved when changing from one field operation to another.

In 1954 our company introduced a hitch, called "Fast Hitch," which incorporated the advantages of unit attachment and in most cases it was possible to attach or detach implements without leaving the tractor seat. Operating depth of the implement was controlled through adjustment of the hitch point actuated by a hydraulic cylinder.

Throughout development of the Fast Hitch one of the main objectives was the development of a hitch that would provide better performance in fields of varying soil conditions and of uneven contour with less attention on the part of the operator. Continued investigation led to a new approach in the design of tractor hitches.

The new hitch, which retains the socket-coupling concept for attaching implements to the tractor, provides single cylinder operation; articulated sockets and a feature described as *traction control*.

Description

The hydraulic cylinder is located at the left rear of the tractor; the piston rod end being pinned directly to the rockshaft arm; with the body of the cylinder attached to a cylinder bell crank that pivots on the left-hand side plate. The sockets are connected to a hitch yoke in front and to rockshaft lift links at the rear for raising and lowering. Spring-loaded latch blocks provide positive retention of implement, coupling beams and leaf springs underneath hold the sockets in relation to the yoke.

Maximum operating depth is controllable by adjustment of the hydraulic cylinder stop which may be adjusted from the tractor seat.

Paper presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1956, on a program arranged by the Power and Machinery Division.

The authors — E. W. TANQUARY and A. W. CLYDE — are, respectively, staff engineer, farm implement division and consultant, test and development section of implement engineering, International Harvester Co.

The front of the hitch yoke has a ball joint connection to a bell crank, permitting a restricted fore and aft movement. A horizontal pitman link attached to the upper end of this bell crank transfers any force from the bell crank to the traction control cam arm. The cam arm pivots on the same center as the cylinder bell crank, permitting contact with the bell crank which, in turn, transmits the reaction to the rear rockshaft.

Action of Mechanical Linkage

Draft action of the implement creates a tension on the horizontal pitman link with a slideable connection to the cam arm. The cam arm reacting against the cylinder bell crank transfers reaction of the implement through the cylinder to the rockshaft. The hydraulic cylinder being inoperative in this case acts as a solid connection.

The control lever, accessible from the tractor seat, permits the operator (as needed) to vary the sensitivity of the linkage. On the Farmall tractors settings permit transmission of approximately 0, 10, 20 or 35 percent of the tractor draft load as a tensile load in the lift links. On the utility type tractor, adjustments are provided for approximately 0, 10, 20, 30 or 45 percent of the draft load.

Fig. 1 illustrates the hitch on the Farmall-450 tractor. Detail construction varies somewhat for other models. Fig. 2 is a schematic drawing to illustrate the operating principle employed in the new hitch.

Use of the control lever accessible to the operator permits variation of the effective lever of the cam arm as needed to suit operating conditions. Selection of the proper degree of sensitivity will permit operation in almost any field without having to change adjustment.

Articulated Sockets (See Figs. 3 and 4)

Unless the sockets are pinned rigidly to the yoke, they can pivot about 9 (Fig. 2). This pivoting action produces the characteristic of locating rearward of the tractor axle, a virtual hitch point determined by the intersection of the center line of the lift links and a line drawn through the hitch yoke ball joint and the socket hinge pins.

The rearward location of the virtual hitch point in connection with a moldboard plow provides the equivalent of a short beam length and is reflected by:

(a) Rapid penetration when entering the ground and the ability to reach operating depth within a short distance of travel, (b) Better response to a change in cylinder setting or in returning to normal depth if the plow has been displaced

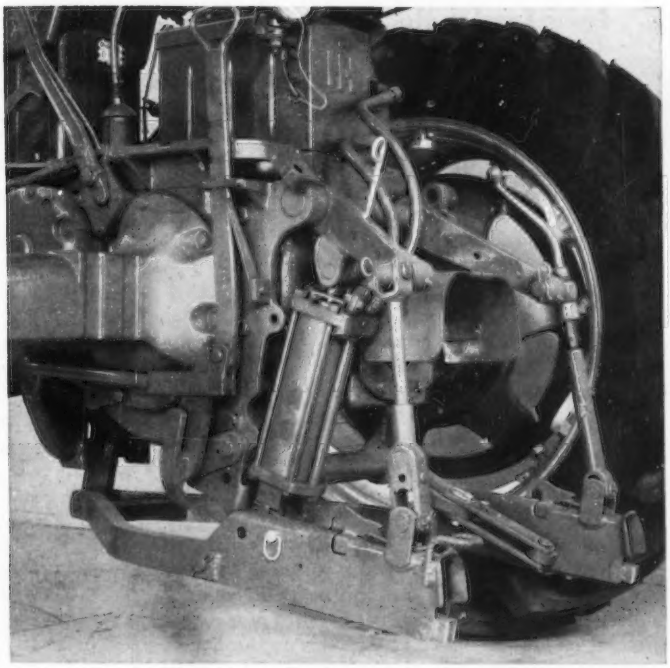


Fig. 1. The new hitch is shown on the Farmall-450 tractor. Construction varies somewhat for other models

for any reason, and (c) Improved ability to follow changes in ground contour.

Traction Control

What the authors identify as traction control is obtained by a combination of articulated sockets for the implement to permit maintaining a more uniform operating depth in a field of uneven contour and a mechanical linkage to increase dynamic loading on the tractor drive wheels to improve traction without added weight. The increase in dynamic loading on the tractor wheels is obtained by variation in the angle of the pull.

Following are force analyses of a 3-bottom moldboard plow in two soil conditions. The conditions chosen will cover the usual range of sod plowing with shares in fairly good condition.

W = Weight
L = Horizontal component of soil resistance
V = Vertical component of soil resistance
RV = Resultant of L and V
R_{2V} = Vertical support from soil
PX = Horizontal component of pull
PZ = Vertical component of pull
PV = Resultant of PX and PZ
F = Virtual hitch point

Fig. 5 illustrates the force diagram in moist soil (easy

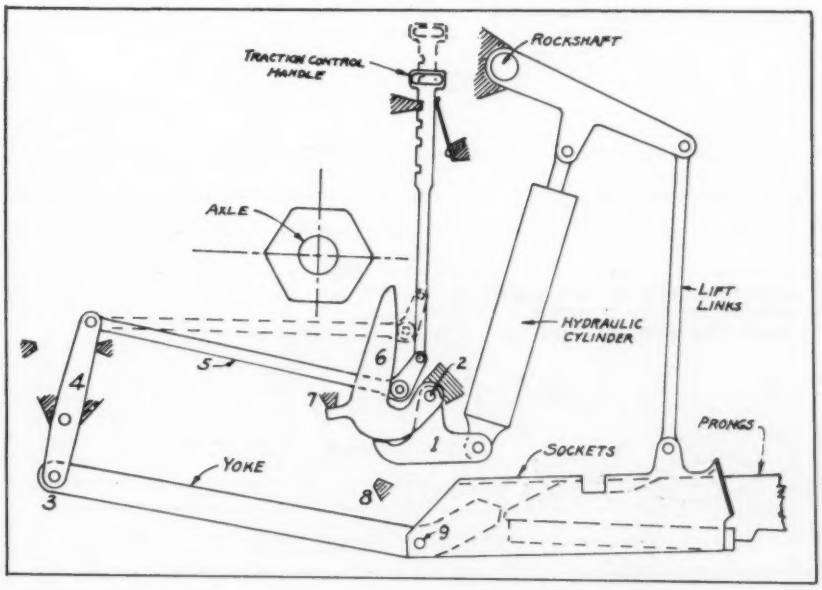


Fig. 2 Schematic drawing illustrates the operating principle employed. The hydraulic cylinder is connected to the rockshaft and to a cylinder bell crank (1) which pivots on the left-hand side plate (2). Coupling sockets are attached to the hitch yoke which, in turn, has at (3) a ball joint connection to a bell crank (4) permitting a restricted fore and aft movement between stops. The horizontal pitman link (5) attached to the bell crank transfers any force from the bell crank to the cam arm (6). The cam arm pivots on the same center (2) as the cylinder bell crank, permitting contact which, in turn, transmits reaction to the rear rockshaft. Use of the control lever permits variation of the effective lever of the cam arm as needed to suit operating conditions

penetration) where the soil presses down on the plow with a force of 225 lb. The first consideration is *RV*, the side view of *L* and *V*. It usually passes through a small area above the point of the average plow point and about one inch below the soil surface. *RV* is then combined with *W*, giving the resultant *AB*. In this case it is only a coincidence that the center of gravity is practically over the point of the average bottom. It may be noted *W* includes the weight of the hitch sockets and one-half of the yoke. The next step is to estimate the location of the support at the rear of the plow. This is estimated at *D*, with the idea that both the rear furrow wheel and the heel of the landside on the rear plow will share this duty. The supporting force is drawn to include a component for friction and rolling resistance. *AB* is now moved along its line of action until it intersects the rear soil force at *E*. The pulling force, *PV*, must balance *EG* and the rear soil force; also, *PV* must pass through *E* and the virtual hitch point *F*. *PV* is thus located and the value of the rear soil force can now be determined. In this case it has an upward component R_{2V} of 250 lb.

With the line of pull located, it is now possible to find how much force must be furnished by the lift links. *PV* is transferred to *F* and there resolved into two parts, one in the direction of the lift links and the other in the line of the yoke. The lift link force of 680 lbs can be furnished entirely by the cylinder if cam No. 6 is against stop No. 7 (Fig. 2). It could also be furnished by leverage (cam No. 6 away from stop No. 7) if the leverage were in the ratio 680/1800. However, if this exact leverage were not provided, then the plow would seek a different depth to get into equilibrium. For this reason, depth control is best if the cam is against stop No. 7.

An important thing to note is that the pull does not pass through the traditional center of resistance of the plow. The common misconception about this has been covered previously (1)*. It is to be expected that since the tractor supports the front of the plow, the tractor must exert considerable upward pull. Thus for equilibrium of vertical forces on the plow, the situation is:

Downward forces on plow: Weight 830 lb, Soil force 225 lb. Total 1055 lb.

Upward forces on plow: Support at rear 250 lb, Support from tractor, *PZ* 805 lb. Total 1055 lb.

Fig. 6 is a similar analysis for a hard penetration condition in which *RV* has an upward component of 300 lb. This is usually due to hard dry ground, but rolling colters and dull shares will contribute to an upward soil force. The same method of analysis is used as in the previous case. It shows that practically no support exists at the rear of the plow, since *F* is almost on the line of *AB*. It is necessary, however, that the lift links furnish 370 lb support in order that the correct line of pull be furnished to the plow.

The disk plow is a tool that cannot stand much upward pull in hard ground if the tool is made rather light for transport. Fig. 7 is an estimate of such a situation. The position of the yoke, the depth of plowing, and the weight of the plow are taken from an actual test. No support was being obtained from the lift links, hence the pull was along the line of the yoke. *RV* is an estimate of the probable soil force. Successful operation has been experienced in very tough dry soil. Further study indicates penetration of hard ground is improved by changing angle of disks and the use of inside bevel disks.

Vertical Flotation

Vertical flotation between the implement and tractor can occur through any one of the following means: *(a)* The cylinder bell crank to which the cylinder is connected is free to rotate away from the cam arm, allowing the rockshaft to float up, *(b)* Pivoting of the articulated sockets, and *(c)* Action of the traction control linkage.

*Numbers in parentheses refer to the appended references.

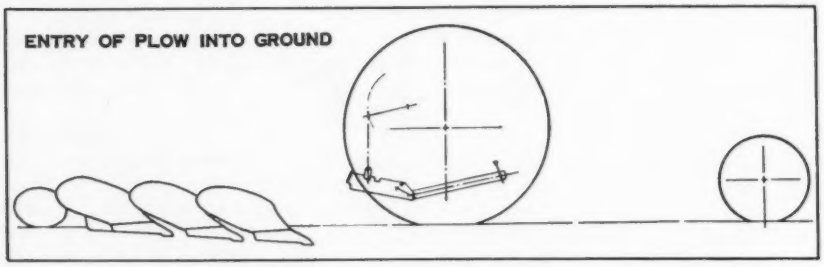


Fig. 3 Shows diagram of plow position as it enters the ground

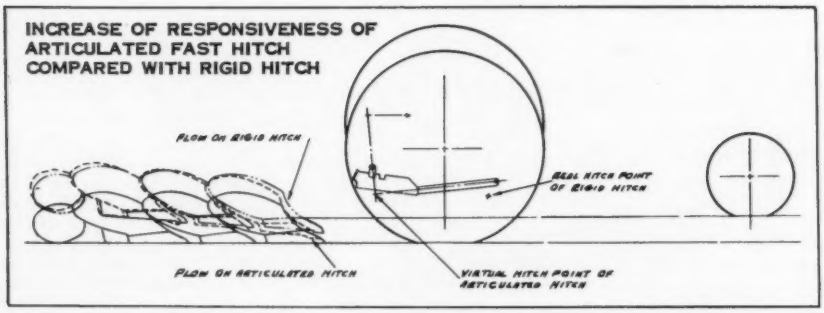

INCREASE OF RESPONSIVENESS OF
ARTICULATED FAST HITCH
COMPARED WITH RIGID HITCH
PLOW ON RIGID HITCH
REAL HITCH POINT OF RIGID HITCH
PLOW ON ARTICULATED HITCH
VIRTUAL HITCH POINT OF ARTICULATED HITCH

Fig. 4 Illustrates comparative positions of plow in respect to rigid and articulated hitches

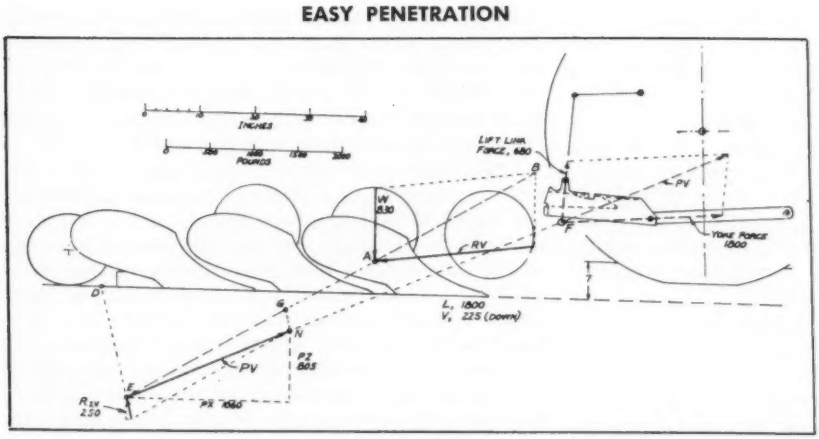


Fig. 5 Illustrates the force diagram in moist soil when plow encounters easy penetration

Indicator

An indicator or "pilot-guide" has been provided for the convenience of the operator. The left-hand pointer indicates extension of the hydraulic cylinder and is a convenient reference in returning the implement to the same working position when reentering the field after turning or after changing working position.

The right-hand pointer is connected to the cam arm to indicate reaction of the traction control linkage, and is used as a guide to assist the operator in selecting the proper ratio of implement reaction to the cam arm for the most efficient operation.

When the control handle is in any one of the upper notches, reaction from the implement pull is effective even though there is no visible movement of the linkage and the pointer remains at or near the bottom line. Then, when tougher soil is encountered, the pointer will move up toward the second line; but will return toward the lower mark and traction control remain in effect after the tougher spot is passed.

Operation

With a moldboard plow, flexibility is achieved principally through the articulated sockets. The tractor wheels

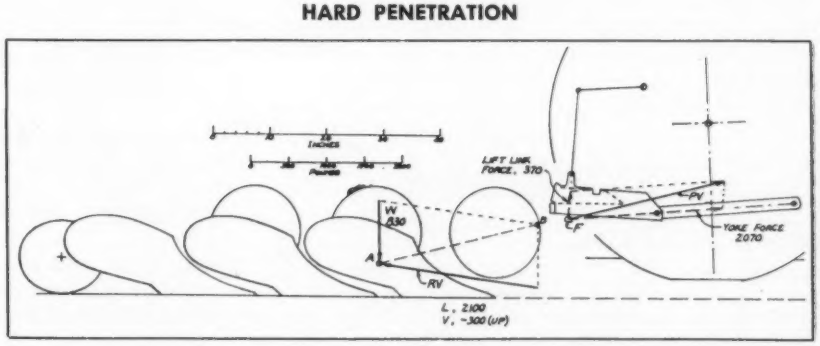


Fig. 6 Illustrates the force diagram when plow encounters hard penetration

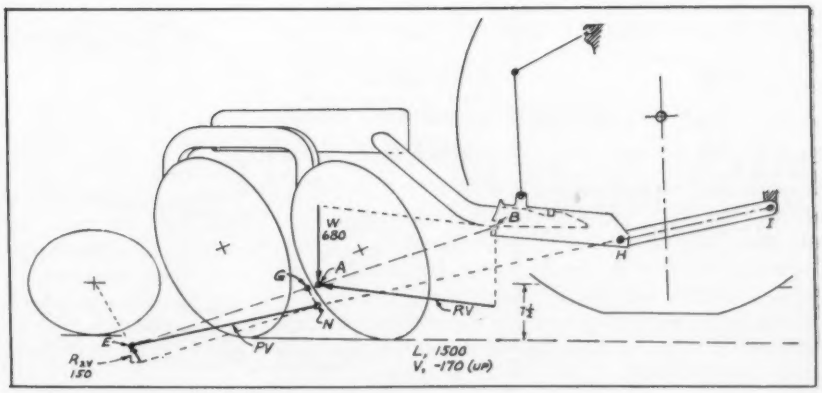


Fig. 7 Illustrates an example when disk plow encounters extra upward soil resistance in hard ground

. . . New Tractor Hitch

gauge the plowing depth, limiting how far the front bottom can go down. At any time the plow is free to come up, either by action of the traction control linkage, or by virtue of rotation of the rockshaft if the loading in the lift links changes from tension to compression. In plowing position the portion of the hitch yoke rearward of the socket hinge pin moves away from its contact with the top of the socket, permitting the tractor to pitch up and down without picking up the rear of the plow. At an 8-in plowing depth this angular freedom amounts to 10 deg.

A good example is when the tractor-plow combination is crossing a terrace or border. As the tractor front wheels cross the top of the terrace and begin going down the decline, the sockets (neglecting traction control) rise slightly due to pitching of the tractor. This raises the virtual hitch point location and the plow begins to shallow up in its approach to the terrace. When the rear wheels have crossed the crest of the terrace, the socket-to-ground distance has generally returned to normal. Thus, the virtual hitch point, by reason of its location rearward of the tractor axle, begins to correct for changes in ground contour before the plow bottoms reach the changed contour. Tractor wheel slippage experienced in crossing ridges has been largely eliminated. Operation of the traction control under these circumstances would tend to dampen the depth variation even further. If the right-hand pointer was just off the lower mark, the linkage could compensate for shallowing up in the approach and would aid in the other direction to keep the plow from going deeper than normal right at the crest of the terrace. The tractor wheels gauge the plowing depth, therefore general instructions point out that the traction control indicator should be at or near the bottom of the slot with the pointer moving up only occasionally. This procedure results in minimum furrow depth variation.

Moldboard plows and disk plows will always operate with articulated sockets. Toolbars, harrows, middlebusters and subsoilers are generally recommended to operate with the sockets pinned rigid with the hitch yoke. The traction control point should be at or near the lower mark when using a two-row buster, less gauge wheels. With gauge wheels, optional equipment for a two-row buster and regular for a four-row buster, the traction control pointer should be near the center of the slot. Fig. 8 shows the float available with this setting and also shows how high the buster could be raised without disturbing cylinder setting before the cylinder bell crank would contact the rearward stop.

Under some conditions in sand or loose soil where traction is marginal, it is desirable to operate the two and three-row middlebuster with articulated sockets to gain increased responsiveness of the system to any change in draft load. Adjusting the coupling beam height to secure the optimum draft angle permits the operator to favor either the tractor or buster. The steep draft angle shown in Fig. 9 would be beneficial in sand, but in harder ground the buster bottoms would exhibit a tendency to stub along on the point. Then they should be adjusted to obtain a draft angle of approximately 20 deg either by re-setting the coupling beams or by adjusting the bottoms on the breakoff.

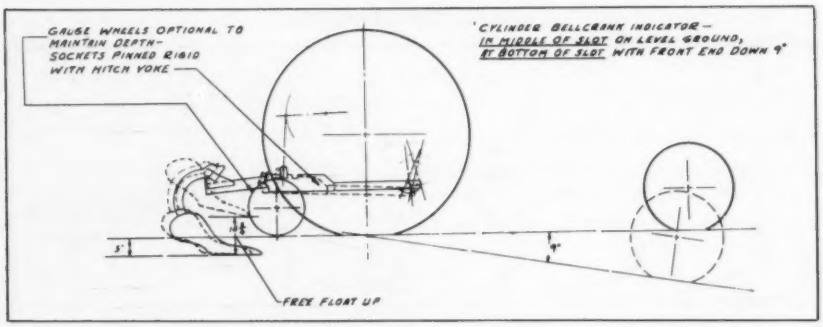

GAUGE WHEELS OPTIONAL TO MAINTAIN DEPTH— SOCKETS PINNED RIGID WITH HITCH YOKE
CYLINDER BELLCRANK INDICATOR— IN MIDDLE OF SLOT ON LEVEL GROUND, AT BOTTOM OF SLOT WITH FRONT END DOWN 9°
5"
9°
FREE FLOAT UP

Fig. 8 Shows the float available and how high a middlebuster can be raised without disturbing cylinder setting before the cylinder bell crank contacts the rearward stop

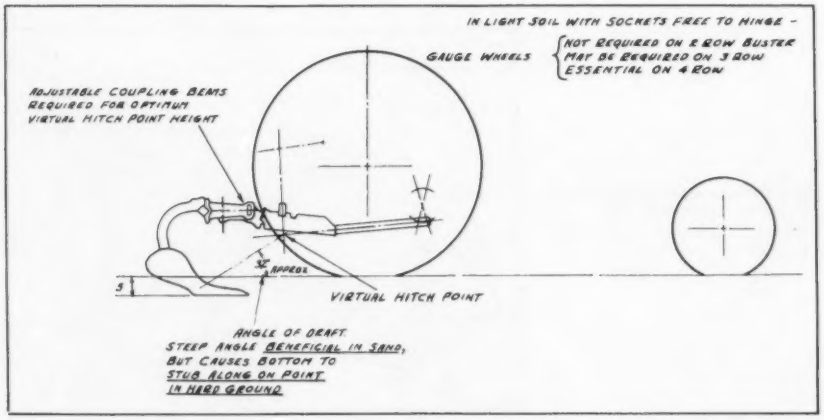

IN LIGHT SOIL WITH SOCKETS FREE TO HINGE —
GAUGE WHEELS
NOT REQUIRED ON 2 ROW BUSTER
MAY BE REQUIRED ON 3 ROW
ESSENTIAL ON 4 ROW
ADJUSTABLE COUPLING BEAMS REQUIRED FOR OPTIMUM VIRTUAL HITCH POINT HEIGHT
APPROX
5"
VIRTUAL HITCH POINT
ANGLE OF DRAFT
STEEP ANGLE BENEFICIAL IN SAND, BUT CAUSES BOTTOM TO STUB ALONG ON POINT IN HARD GROUND

Fig. 9 The steep draft angle shown would be beneficial in sand, but in harder ground the buster bottoms would have a tendency to stub along on the point

Versatility for Other Implements and Operation Conditions

Lateral movement of the sockets is controlled by a welded pin moving within the confines of a slot in the lateral limit plate. Lateral swing can be eliminated by inserting the QA pin (removed from a storage hole in the limiter straps).

Provision for using drawbar as a jack to raise either rear wheel is retained and is accomplished by using a pin to lock out action of the cylinder bell crank.

Oscillatory motion required for disk harrows and implements having wide spaced gauge wheels is accomplished by lowering the collar on the leveling screw to the second countersink and changing the pin on the left-hand link from the clevis and float block to the storage hole in the block.

The lift links can be detached from the lifting rockshaft and pinned to the hitch side plates to provide a rigid vertical position for certain types of drawbar work.

Conclusion

It is the opinion of the authors that engineers will find the new approach to the design of tractor and implement hitches most interesting and that it will open new vistas for still further improvement in the important phase of farm equipment design.

Field experience has shown the following operational characteristics which are felt to be desirable for efficient operation of rear mounted implements:

- Greater flexibility, permitting quicker entry and obtainance of operating depth and maintenance of more uniform depth in fields of varying contour.
- Retained unit attachment of the implement; in most cases accomplished without the operator leaving the tractor seat.
- Increased dynamic loading for the rear wheels is variable to suit operating conditions; thus reducing the need for added weight.
- Increase in dynamic loading for rear wheels being accomplished by mechanical linkage does not deprive the tractor of horsepower to operate the hydraulic pump at the time maximum power is needed to negotiate a tough spot in the field.
- Action of the traction control linkage, being constant, does not overcorrect and will allow the implement to maintain a more uniform operating depth in field of variable soil texture.

References

1 Clyde, A. W. Pitfalls in applying the science of mechanics to tractors and implements. AGRICULTURAL ENGINEERING, vol. 35; pp. 79-83, February, 1954.

. . . Self-Feeder Silo

(Continued from page 86)

The use of a quick-acting on-off control mechanism will reduce operating time considerably. Thirty mature animals can feed simultaneously from the silo. The cattle feed easily and quickly from the round feeding manger.

References

1 Reed, C. H. Structures for self-feeding of hay and ensilage. AGRICULTURAL ENGINEERING, vol. 32, p. 375. July, 1951.

2 Barnes, K. K., and Beresford, H. Self-Feeding of Chopped Hay, AGRICULTURAL ENGINEERING, vol. 35, pp. 551-583, August, 1954.

. . . Fluted Nails

(Continued from page 87)

southern pine into 1-in dolomitic-limestone-aggregate, 1110-psi, 3-day-old concrete of 2340-psi, 28-day strength. It increases to 839 lb in 28 weeks after being driven into the same 1605-psi, 7-day-old concrete of 3170-psi, 28-day strength. Since directly comparative tests were performed during the study with the same size powder-driven studs, the statement can be made that the light fluted masonry nails should provide ample holding power in concrete if twice the number is used as is required by governing specifications for same-size powder-driven studs.

Basic data on the axial withdrawal resistance of heavy-duty fluted masonry nails, immediately after being driven with a 6-lb hammer through nominal 2x4-in southern pine into the above 3, 7, and 28-day old concrete of 2730-psi, 28-day strength, indicate that this heavy-duty nail provides immediate withdrawal resistances of 972, 1264, and 1621 lb, respectively. The relatively low immediate holding power of 972 lb for this fastener driven into the 3-day-old concrete increased, however, to 1810 lb in 28 days after being driven, with increase in concrete strength during its aging. The resistance of this nail to lateral shear and bending loads immediately after being driven into the above 7-day-old concrete, 12 in from the nearest concrete edge, amounted to 2928 lb. If driven into the above ½-year-old concrete, 4 in from the concrete edge and 12 in from the concrete end, the shear resistance increased to 3550 lb. Driven at an edge distance of 3 in and an end distance of 8 or 6 in. into this ½-year-old concrete, the average shear resistance of the heavy-duty nails amounted to 2330 and 2220 lb, respectively.

According to directly comparative data for the heavy-duty fluted masonry nails and 3½x$\frac{7}{32}$-in powder-driven fasteners, those data on the holding power of the heavy-duty nails proved to be better than those for the powder-driven studs. Hence design values for these studs can be directly applied to the heavy-duty nail.

For the light nail, a minimum concrete edge distance of 2 in and a minimum concrete end distance of 3 in are recommended. The heavy-duty nail may be spaced as near as 3 to 3½ in from the concrete edge and 6 to 8 in from the concrete end. On the other hand, the joint stiffness and resistance to shear of the heavy-duty nail are approximately 30 percent larger if the end spacing of the nail, driven 3 in from the concrete edge, is 12 in instead of 8 or 6 in. The selection of edge and end spacings depend to a certain extent on the consistency of the concrete, since splitting of the concrete must be avoided under all circumstances.

Credit Due Deere Engineers for V-Belt Tester

A REPRESENTATIVE of Dayton Rubber Co. brought to our attention that the caption for the illustration on page 805 of the December issue failed to give credit for developing the V-belt tester shown. It seems that engineers at the John Deere Harvester Works, East Moline, Ill., designed the machine and were first to use it for testing V-belts for combines. Later Dayton Rubber Co. adopted the machine for laboratory testing.

Bulk Milk Cooler Field Studies

Field studies of bulk milk coolers on farms in six states bare many of the problems and growing pains that have resulted from a phenomenal rate of increased usage and the rapid switch to bulk handling of milk within the past few years

C. N. Turner
Member ASAE

THE use of bulk milk coolers on farms has increased in the number of installations in the United States from 5,882 in July 1, 1953, to 19,234 in March 1, 1955, or 227 percent. In view of this phenomenal increase and the many agricultural engineering factors involved in the design, installation, and operation of bulk coolers the author conducted a field study in six states—Maine, Indiana, Michigan, Wisconsin, Minnesota, and Maryland. The seasons of the year represented are winter, spring and summer of 1955.

Detailed records were taken in 14 areas on 120 farms. The major guide in selecting the coolers was to obtain a variety of types, sizes, and manufacturer's equipment. The bulk coolers studied were manufactured by 14 different companies and the tank sizes ranged from 80 to 1000 gal.

The Dairyman

The dairy farmers represented in the study were milking from 8 to 90 cows. Variations in stable and milking equipment were many. Relatively few dairymen had remodeled their milkhouse specifically for the use of a bulk cooler. A considerable number had constructed a milkhouse with adjacent milking-stall arrangements and bulk cooling had been combined with the pipe-line milking system.

The investment in the bulk-cooling equipment was the major obstacle in the change-over from the can to the bulk method. All dairymen contacted were enthusiastic, however, about the bulk method and not one had considered changing back to the old method. Some dairymen had urged the hauler and/or the milk plant to accept the bulk-handling method. In most areas, however, the farmer was not given the freedom to select his bulk cooler without considerable influence on the part of the organization buying his milk.

The Hauler and Pickup Schedule

The payload of a bulk-tank truck is better than a truck handling milk in cans because there is neither can weight nor wasted truck space. The maximum savings in hauling had not yet been realized, because bulk-cooler installations were scattered on most routes.

In four areas, the electric-motor-driven milk pumps on the truck gave considerable difficulty. A milk plant in each area had elected to power the motor from 115-volt circuits at the farm even though 230-volt power was available on all farms studied in these areas. The use of 1-hp motors on this lower voltage resulted in frequent fuse blowing and even one motor burnout. Operation of similar equipment on 230-volt circuits was found to be satisfactory in the other areas. The higher voltage has been recommended for farm motors ½-hp or larger for several years.

All areas except one were on the every-other-day pickup schedule. There were, however, a few dairymen who were on an every-day schedule because they were located so that the tank truck could include them in the pickup from other routes. In one area a Monday, Wednesday, and Friday pickup with no pickup on Saturday or Sunday was used. These farmers had to purchase bulk coolers adequate to hold at least six milkings and usually seven for peak production.

The Bulk Tank

The condition of the inside metal surface on all the milk tank liners was good. A few deposits of milkstone and/or dried milk were observed but this appeared to be only a temporary condition. Fifty-three tanks had exterior walls of stainless steel and 67 of painted steel. The stainless steel surfaces were found to be in excellent condition, but 19 tanks with painted steel exteriors showed varying degrees of chipping, peeling, and wear that frequently resulted in rusted spots. In addition to these areas, rust was often found over welded material used to join the seams, hinges, or various parts of the tank components. Rusty areas were also common on the underside of tanks near the milkhouse floor.

TABLE 1. NUMBER AND PERCENTAGE OF TANKS STUDIED, BY SIZE

Size of tank, gal	Number	Percentage
80	2	1.7
100	2	1.7
150	13	10.8
200	13	10.8
250	11	9.2
300	36	30.0
400	24	20.0
500	7	5.8
600	7	5.8
700	3	2.5
800	1	0.8
1000	1	0.8
Total	120	99.9

The size of the milk tank selected by the dairymen in-

Paper presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1955, on a program arranged by the Rural Electric Division.

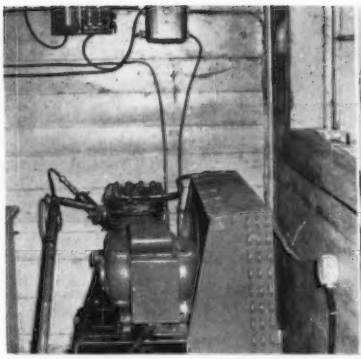
Acknowledgments: The author wishes to acknowledge the assistance of the members in the agricultural engineering departments of the colleges in each state that made this study possible.

The author—C. N. TURNER—is professor of agricultural engineering, Cornell University, Ithaca, N. Y.

cluded in this study resulted in a calculated average of 10.3-gal of tank capacity for each milking cow in the herd. The range in tank capacity per cow was 4 to 23 gal. All but eight of the 120 coolers were used to hold milk for every-other-day pickup. Table 1 shows the percentage of those found in each size group.

Fifty percent of the tanks were the 300 and 400-gal size and another 30 percent were the 150, 200, and 250-gal. size.

Seventy-five dairymen reported that their tanks had adequate capacity for their herds during the next five years; 21 dairymen did not have adequate capacity, and the others were not sure or were not at home.



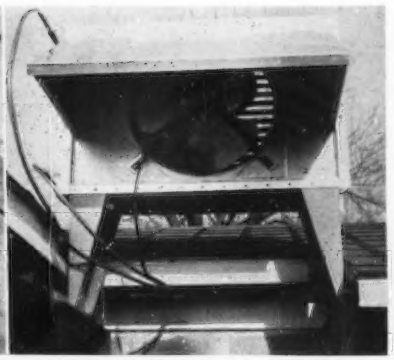


Fig. 1 *(Left)* Limited ventilation for the air-cooled part of the condenser was found on 53 of the 71 direct-expansion coolers that had condensing units separated from the tank • Fig. 2 *(Right)* Large air-cooled condensers like this were required for some direct-expansion coolers when the farm water supply was limited or contained minerals

Eight tanks of the vacuum type were included in the study. Six tanks were being used with a pipe-line milking machine and two with bucket milkers. All but one dairyman reported difficulty with air leakage around lid gaskets agitator shaft seals and/or milk delivery tube.

The Cooling System

120 bulk coolers were studied.

37 coolers used the ice-bank cooling system.

83 coolers used the direct-expansion system.

62 coolers were of the package-unit type assembled by the manufacturer.

58 coolers had the condensing unit installed separate from the tank.

35 of the ice-bank coolers were of the package-unit type.

53 of the direct-expansion coolers had separate condensing units which were assembled at the farm (Fig. 1).

Ice-Bank Coolers (37)

Difficulties encountered by users of ice-bank coolers:

3 coolers had condensing units replaced; one was damaged by lightning, one was on too-low voltage, and the other was damaged from inefficient condenser cooling in a milkhouse with glass-block window construction and no ventilation. All units were replaced within the 5-year warranty period.

3 coolers had refrigerant leaks serviced at low cost.

5 of the early model coolers had been equipped with single-speed agitator motors that were reported to cause the milk to foam. These were replaced with 2-speed units.

2 early model circulating pumps had been replaced because of bearing failures.

1 cooler had rusty water because the water supply contained iron and was extremely corrosive. There was no visible corrosion of the stainless steel ice chamber liner.

2 coolers had thermostat failure causing the water-circulating pump and agitator not to start.

2 coolers were reported to have poor cooling performance.

2 coolers were reported to have had an incorrect charge of refrigerant.

3 coolers had an inadequate supply of ice for fast cooling. The remedy was found in relocation of the ice-bank control.

1 cooler required too much time to remove the last quart of milk, as reported by the trucker.

Direct-Expansion Coolers (83)

Difficulties encountered by direct-expansion coolers:

19 coolers had freezing of milk reported.

2 vacuum-type coolers required periodic manual operation to prevent freezing during the first milking period.

12 coolers stopped frequently during the milking period as a result of heavy loads on the refrigerating system. The following causes were reported most frequently: Insufficient cool air for the air-cooled condenser, inadequate supply of water for the water-cooled condenser, the inability of the air-cooled part of combination air-and-water cooled condenser to remove the heat on warm days when the water had been drained for cold weather operation, and compressor too small for the load of milk to be cooled. Several refrigerant pressure-switch settings on other coolers were observed to be more than 200 psig, which indicated that head pressures had been high.

4 coolers had to have low pressure-control settings changed so that the condensing units would operate in cold weather.

10 coolers had stopped one or more times during the milking period because of an overloaded motor causing the thermal overload protection for the motor to trip.

7 of these had been made ineffective by bridging or tampering in other ways to prevent tripping.

10 coolers had failure of thermostat controls.

3 coolers were erratic and gave poor temperature control.

9 coolers had refrigerant leaks that resulted in the replacement of large quantities of Freon.

6 coolers gave poor cooling performance for reasons unknown.

5 compressor motors had been overloaded and replaced or repaired due to burnouts.

3 motors had been replaced by the next larger size because of an excessive overload.

3 coolers caused frequent fuse blowing due to heavy loads on the compressor motor and one branch circuit cable to a cooler was replaced after a heavy current overload had destroyed the insulation.

3 coolers had compressors replaced.

4 coolers had air leaks around the cover gaskets and agitator shaft seals.

4 coolers had improper agitation causing butterfat separation.

9 gear-type drives leaked grease onto the tank cover or bridge.

2 of the 9 gear-type drives had agitator-shaft couplings that deposited dark particles of metal in the milk.

3 water regulating valves were found leaking on coolers equipped with combination air-and-water-cooled condensers.

1 dairyman reported freezing damage to the water-cooling coil on his condensing unit and 5 other dairymen were reported to have had the same experience.

The Condensing Units

Ice-bank systems:

31 coolers had straight air-cooled units.

6 coolers had combination air-and-water-cooled units.

Direct-expansion systems:

40 coolers had straight air-cooled units.

37 coolers had combination air-and-water-cooled units.

6 coolers had straight water-cooled units.

53 units of the 71 air-cooled condensers had an inadequate cool air supply (Fig. 1).

2 coolers had special air-cooled condensers mounted on the roof of the milkhouse (Fig. 2).

. . . Bulk Milk Coolers

14 coolers operated largely on water and cycled frequently on warm days when the water-cooling system had been drained for cold weather protection from freezing.
3 of the 6 water-cooled condensing units cycled frequently because of insufficient water and slow cooling resulted.
56 coolers had open-type, belt-driven compressor assemblies with a separate motor.

Only direct-expansion coolers were equipped with open-type belt-driven compressors.

All types

28 installations had inadequate condenser cooling because of the absence of good cross ventilation.
7 installations had inadequate cooling because glass-block windows were used.
15 units, of the 43 combination air-and-water-cooled units, had an adequate supply of cool air.
41 coolers had semisealed compressor assemblies.
23 coolers had sealed compressor assemblies.
9 coolers had refrigerant leaks; 7 of these were with the open-type compressors.

The size of the condensing-unit motors ranged from ⅓ to 5 hp as shown in Table 2.

TABLE 2. SIZE OF MOTOR ON CONDENSING UNITS

Horsepower	Number	Percent
⅓	1	0.8
½	7	5.8
¾	12	10.00
1	20	16.7
1½	26	21.7
2	27	22.5
3	25	20.8
5	2	1.7
	120	100.0

Because of the large proportion of direct-expansion coolers, 45 percent of the motors were 2 hp or larger. The direct-expansion compressor motors averaged 1.1 hp for each 50 gal of tank capacity per milking on every-other-day pickup routes and 0.74 hp for each 50 gal on every-day pickup routes. All but two ice-bank coolers were reported to be rated for every-day pickup, and therefore the compressor motors were about twice the size needed when used on every-other-day pickup routes. The advantages of using every-day tank for every-other-day pickup would be: *(a)* that the operating time could be reduced approximately one-half when used on an every-other-day schedule, *(b)* the manufacturer could eliminate several models, and *(c)* the dairyman could shift from an every-other-day pickup schedule to an every-day schedule without making any changes in the refrigeration capacity of his cooler.

The compressor motors on the 83 direct-expansion coolers studied were carrying from 50 to 151 percent of full-load current rating. Table 3 shows complete breakdown.

TABLE 3. COMPRESSOR MOTOR LOADS ON DIRECT-EXPANSION VS. ICE-BANK COOLERS

Percent of full load	D-E number	Percent of total	I-B number	Percent of total
Less than 100	42	50.6	23	62.2
100 - 110	11	13.3	13	35.1
110 - 114	10	12.1	1	2.7
115 - 119	8	9.6	—	—
120 - 139	9	10.8	—	—
Over 140	3	3.6	—	—
	83	100.0	37	100.0

All but a few were checked with cold milk in the tanks and under what should be considered light-load conditions.

The loads carried by the motors on ice-bank compressors ranged from 65 to 112 percent of full-load rating as is shown in Table 3.

Thermal overload elements were provided for protection on all the compressor motors on the coolers studied. Many, however, were ineffective because they had been bridged, improperly installed, or selected too large for the current rating of the motors. Table 4 shows breakdown on the ratings of thermal overload elements on direct-expansion coolers. All ice-bank coolers had built-in thermal overload elements provided by the condensing-unit manufacturer.

TABLE 4. THERMAL OVERLOAD ELEMENTS FOR COMPRESSOR MOTORS

Direct-Expansion Coolers		
Percent of full load	Number	Percent of total
Less than 100	30	36.2
100 - 114	6	7.2
115 - 124	9	10.8
125 - 139	18	21.7
140 - 160	11	13.3
Over 160	9	10.8
Total	83	100.0

When the motors on bulk coolers carry refrigeration loads that require thermal overload element sizes larger than 125 percent of full-load current, the element will not comply with the minimum standards of the National Electrical Code for safety from fire hazards. These large elements also do not provide necessary protection against motor burnout. In addition, most guarantees from motor manufacturers are void when the motor is loaded beyond the usual "service factor" of 1.2 for 1½ to 2 hp or 1.15 for 3 hp and larger sizes.

All water-circulating pump motors used on ice-bank coolers were equipped with built-in thermal overload protection provided by the motor manufacturer. No pump motor was found carrying more than its full-load current rating.

The Agitator

120 agitators had totally-enclosed motors ranging in size from 1/20 to ½ hp, as shown in Table 5.
9 of the 94 gear-type agitators drives leaked grease.
25 coolers had V-belt agitator drives and 2-speed motors.
26 direct-expansion coolers used the same thermal overload element to carry current and protect both the agitator and compressor motors. This resulted in little protection for either motor.
28 agitator motors had no overload protection.
13 were protected by thermal overload switches.
37 agitator motors had built-in overload devices.
6 agitator motors had time-delay fuses.
9 agitator motors had individual thermal elements in the 3-pole magnetic motor starter.

TABLE 5. SIZE OF MOTOR ON MILK AGITATORS

Horsepower	Number	Percent
1/20	1	0.8
1/12	3	2.5
⅛	8	6.7
⅙	33	27.5
¼	46	38.3
⅓	26	21.7
½	3	2.5
	120	100.0

There was little correlation between agitator motor hp and the capacity of the milk tank. There were ½-hp motors on 250 and 300-gal tanks, ⅛-hp motors on 80-gal tanks, ¼-hp motors on 150 to 700-gal tanks and ½-hp on 200 to 1000-gal tanks.

Time-delay fuses provided by one direct-expansion cooler manufacturer for protecting agitator motors were rated 200, 212, 223 and 425 percent of full-load current rating. Special fuse holders had been used that prevented any reasonable protection for these motors. In addition, by attempting to provide this type of protection rather than through a 3-pole magnetic-starter, the interlocking feature with the compressor motor was eliminated. That is, if the time-delay fuse stopped the agitator motor, the compressor motor could continue to run and freeze the milk.

Either due to the partial loads of milk in the tanks or to considerable excess horsepower available in the agitator motors, or to both, not one carried more than its full-load rating.

The Control System

Automatic operation:

120 coolers had thermostat controls for automatic operation.

117 had the sensing element in contact with outside of milk tank liner.

3 had the sensing element suspended directly into the milk.

Ice-building and cooling operations:

1 ice-bank cooler had a mechanical timer in which operator had to estimate time required to build an adequate supply of ice to circulate chilled water for adequate cooling.

36 ice-bank coolers had one thermostat with contacts that carried the water-circulating pump and agitator-motor currents directly.

Starters:

57 direct-expansion coolers had an expensive magnetic starter or relay to carry the heavy current of the large compressor motors. The thermostat contacts carried the current for the magnetic coil in the starter or relay for the direct-controlled system, or for the refrigerant solenoid valve in the indirect-controlled system.

9 indirect-controlled, direct-expansion systems used the high-low, refrigerant-pressure switch to carry the current for the magnetic coil in the motor starter or relay.

56 coolers had no provision for manual starting.

28 of the 56 coolers were ice-bank system and such a provision is seldom necessary.

55 direct-expansion coolers had manual starting of the condensing unit and of the agitator motor; 21 of these used a mechanical start button on the thermostat.

23 coolers used a mechanical timer.

9 coolers used a single-pole, double-throw switch to by-pass the thermostat.

NOTE: The desirable feature of the mechanical start button and the mechanical timer is that manual control automatically returns to thermostat operation. The single-pole, double-throw switch is undesirable because it requires manual return to thermostat operation and if forgotten the milk may freeze.

25 ice-bank coolers used a double-pole, single-throw switch to by-pass the thermostat for manually starting the water-circulating pump and agitator for fast cooling.

12 ice-bank coolers used a mechanical timer. The mechanical timer is preferred since failure to return the double-pole, single-throw switch to automatic position results in continuous operation of the cooling equipment and destabilization of high-fat milk has been reported.

32 coolers had interlocking protection between agitator and refrigerating equipment. Such protection is essential for direct-expansion coolers. A 3-pole magnetic starter provides separate thermal overload protection for the agitator and the compressor motor. If either motor becomes overloaded, both will stop. This prevents freezing the milk if the agitator motor stops or prevents excessive agitation if the compressor motor stops.

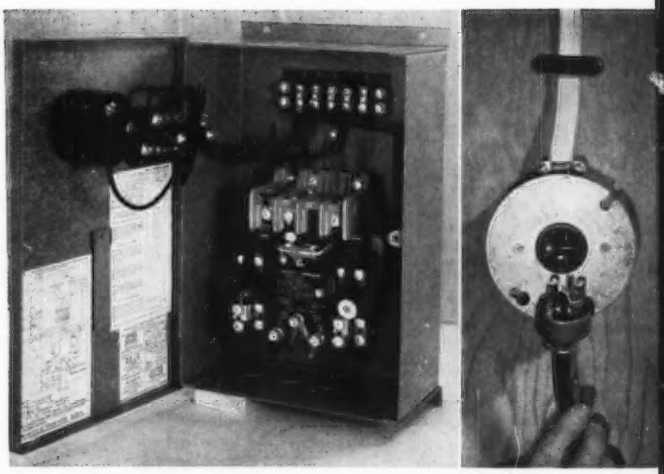


Fig. 3 *(Left)* This electric control panel used by one direct-expansion cooler manufacturer incorporates most of the desirable features recommended by the agricultural engineering department at Cornell in 1953. Two additional features would improve it considerably: *(a)* substitute a mechanical timer in place of the mix-off-automatic for a manual control of the agitator that would return to automatic operation without manual assistance, and *(b)* replace thermal overload element tables, inside the cover, that use 140 percent of full load compressor motor ratings with tables using 125 percent ratings to comply with national electrical code standards for protection from "burn-out" and possible fire hazards • Fig. 4 *(Right)* The three-pole 230-volt receptacle with U-type grounding terminal should be used in the farm milkhouse for the portable truck pump motor to comply with national electrical code standards

16 direct-expansion coolers had provision for stopping the agitator if the compressor overload tripped, but the compressor would not stop if the agitator overload tripped.

37 (all) ice-bank coolers did not have interlocking protection between circulating pump and agitator motor. This is not too important because freezing of milk is no problem. Agitator operation without water-circulating pump operation, however, could result in excessive agitation that might cause destabilization, if milk temperature remains above 50F.

Agitator controls:

114 agitator motors were controlled automatically by the thermostat responding to milk-tank temperature.

4 agitator motors were controlled only by mechanical timers.

1 was controlled manually by plugging into a live duplex receptacle.

1 was not recorded.

NOTE: The mechanical timers had to be reset after the maximum 2-hour setting. Agitator motors controlled only by mechanical timers were not desirable because they had to be set after the 2-hour maximum setting to insure adequate cooling and then might result in unnecessary agitation.

82 coolers had a manual control for the agitator separate from that of the refrigerating equipment.

36 coolers were equipped with "hand-off-automatic" controls or single-pole, double-throw switches.

11 coolers used a single-pole, single-throw toggle switch.

11 coolers used a mechanical timer to by-pass the magnetic starter on direct-expansion systems.

25 ice-bank coolers used a double-pole, single-throw switch to by-pass the thermostat and to operate the agitator and circulating pump together.

3 coolers used a mechanical timer for all agitator operation.

Only seven coolers had most of the necessary control and protection features recommended by the agricultural engineering department at Cornell University early in 1953 (Fig. 3).

(Continued on page 100)

Recharging Ground Water b

W. A. Hall, R. M. Hagan and J. D. Axtell
Member ASAE

GROUND water recharge is rapidly becoming a serious problem in many areas, especially in the arid west. A large proportion of the water used in irrigation is pumped from underground reservoirs. Water tables have been lowered more than 400 ft in some localities.

Mining water in this fashion cannot continue without providing an adequate volume of return flow. Considerable research is underway in California, Arkansas, Kentucky, and Ohio. Recharge has been accomplished with varying degrees of success through surface flooding, trenches, pits, recharge wells, and shafts. The results of this research have been reported elsewhere. (1, 2, 3, 4).*

This paper discusses "replenishment irrigation" as a major supplement to other methods of ground water recharge. Replenishment irrigation may be defined as excessive irrigation of crop land at those times of the year that surplus surface water is available and will not cause damage or delay to crops.

Preliminary studies of the feasibility of replenishment irrigation disclosed three possible limiting factors. First is the possibility of damage to perennial crops at any time of the year. Second, spring is the time during which the most surplus water is available. Unfortunately, it is also the time for the farmer to be in his fields preparing the land, or when crops are growing. Third, there is the possibility of leaching of nutrients out of the root zone. The latter two possibilities have major support from an unsuccessful attempt by the Kern County Land Co., Bakersfield, Calif., to over irrigate barley as a means of ground water replenishment. However, alfalfa and some other perennial crops seem to be quite resistant to the effects of excess water so long as they are dormant and drainage occurs before regrowth begins.

The normal means of ground water recharge show a marked decline in ability to recharge with time. Hence, any recharge accomplished during the dormant season would reserve the peak capacity of other recharge systems for later in the season.

Paper prepared expressly for AGRICULTURAL ENGINEERING.
The authors—W. A. HALL, R. M. HAGAN and J. D. AXTELL—are, respectively, assistant professor of engineering (Los Angeles) and irrigation engineer in the Experiment Station (Davis), University of California; associate professor of irrigation, University of California, Davis; and superintendent of company farming, Kern County Land Co., Bakersfield, Calif.

*Numbers in parentheses refer to the appended references.

The Experimental System

With these factors in mind, research was begun in the fall of 1955 as a cooperative study by the University of California, Davis, and the Kern County Land Co. Forty-five checks of 1⅓ acres each were designated from a field of 3-year old alfalfa. Three adjacent checks were used for each treatment. Observations were taken only in the center check to minimize side effects. Treatments consisted of varying periods of flooding during both the beginning and end of the period in which the alfalfa was expected to be dormant. Included was a continuously irrigated treatment and one irrigated continuously for one week every other week. The stand and general appearance of the field was not as uniform as might have been desired. One end of the field showed some damage from the alfalfa aphid. Accordingly, liberal use was made of control checks so that effects of replenishment irrigation could be compared with similar untreated areas.

Percentage of plant mortality was chosen as the most significant variable expected to be affected by the irrigations. Yield data, although provided for, were not expected to give reliable results because of the wide variation experienced from place to place and from year to year in the fields. Three sites for plant counts were laid out in the center check of each treatment. Each site was approximately 4 by 5 ft. Each count was made by two persons. Five different persons engaged in counting and teams were rotated so that each person counted plots with every other person. Disagreements in the counts were seldom greater than six or seven plants for any plot. Most counts were within three plants of agreement. Thus, while it is difficult to say whether the absolute value of the plant count is correct with-

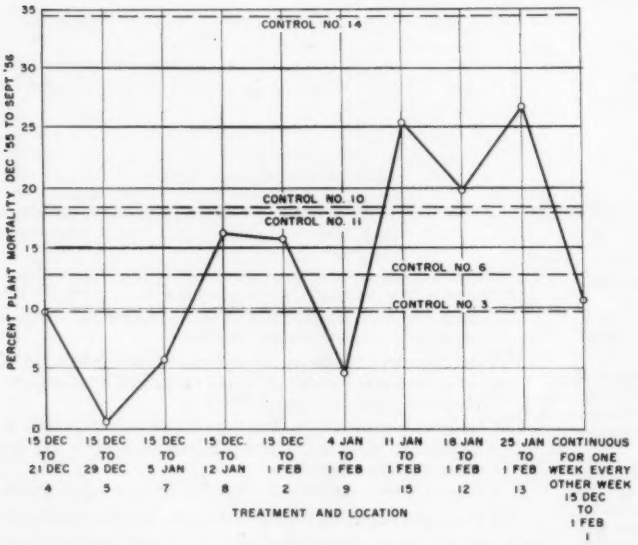


Fig. 1 Percentage plant mortality for various treatments including controls. Note that the increase in plant mortality from one end of the field to the other is slightly greater for the untreated (control) checks than for the treated checks

by Irrigation

Excessive irrigation when surplus surface water is available has been tried as a supplement to other methods of replenishing ground water supplies. Benefits claimed have been weed control and improved hay quality

out actually digging out the crowns, the consistency of the counts indicates reliability in the relative magnitudes of plant mortality percentages.

In order to determine the presence or absence of localized drainage problems from perched water tables, observation wells were dug to a depth of 3 ft near each of the plots. These were observed to be dry throughout the testing period.

Water was measured onto the center check of each treatment by means of a triangular weir. Tail water was kept to a minimum by adjustment of the discharge.

Results

Fig. 1 represents graphically the mortality of the plants for each treatment. Treatments are identified by the dates on which flooding was commenced and ended. The last vertical line at right of chart represents the check irrigated continuously for one week every other week. The control check mortalities are shown as dashed lines extending across the entire chart. The lines between points are for visual convenience only. If each treatment is compared with the controls lying nearest to it, it is apparent that there is no significant effect of excessive winter irrigation during the experimental period on the ability of a three-year old alfalfa plant to survive. The high mortality of treatments of three weeks, two weeks, and one week in January, do not reflect a greater mortality for January irrigation since they are still below the average of the three controls in the vicinity. That this is due to location and not to the time of the irrigation is fortified by the low mortalities observed in checks 1, 2, and 9. Each of these received irrigation until the end of January. The conclusion is that the excessive irrigation has not affected plant mortality for any of the treatments. The trend to higher plant mortality observed for both controls and treatment is probably due to the observed greater damage by alfalfa aphid during the preceding summer.

Although yield data were not expected to give conclusive results, the number of bales of hay taken from the center check of each treatment was observed for the first cutting and the sixth cutting. The continuously irrigated check showed a decrease in yield of the order of ten percent in the first cutting but with no significant decrease for the sixth cutting. Although little statistical significance can be attached to the first cutting loss, on the basis of general observations made during the progress of the experiment, the authors believe that such a harsh treatment could have set the first growth back sufficiently to reduce the first cutting yield.

An interesting sidelight to the study was the complete control of weeds in those checks where water was applied on December 15 and maintained continuously for two weeks or more. Irrigation begun in January did not control the weeds whenever they had grown sufficiently to keep part of the plant above the water. Observations made February 10 showed many tall vigorous weeds on the control plots while the December irrigations of more than two weeks duration were essentially free from all weeds except bermuda grass. This reduction in weeds was still apparent after the sixth cutting in September.

The general observations made February 10 showed considerable yellowing of the plants in the continuously flooded check. Somewhat yellow areas were noted in all plots irrigated in excess of four weeks, later irrigations being more pronounced in their effects than earlier irrigations of the same duration. All treatments had considerable fungus-like mottling of the leaves. Heavily irrigated treatments appeared to be affected more than the controls, but the difference was not as pronounced as it was in the case of the color. Alfalfa leaves below the water line were adversely affected, the degree of effect appeared to be related to the period of submergence. The consensus of the observers was that irrigation much beyond February 1 would have resulted in considerable damage. Regrowth was well along by February 10 (earlier than usual but not at all uncommon for this area).

The average volume of water recharged per week for each acre of each test plot is shown in Fig. 2. Also plotted for comparison is the volume of recharge for the first week only. Dotted lines are again for visual convenience only.

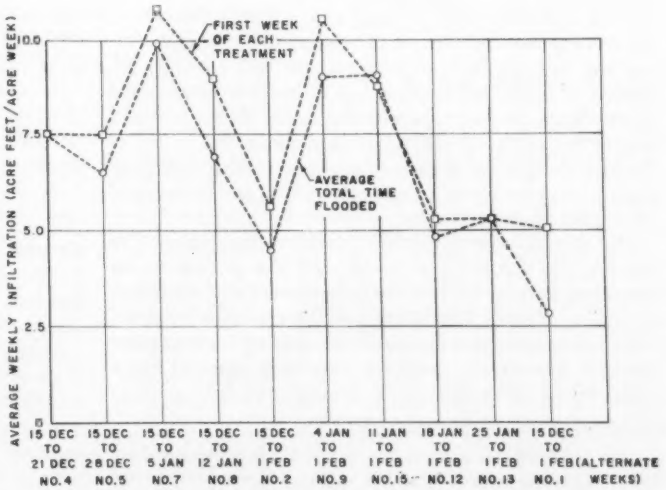

AVERAGE WEEKLY INFILTRATION (ACRE FEET/ACRE WEEK)
10.0
7.5
5.0
2.5
0
FIRST WEEK OF EACH TREATMENT
AVERAGE TOTAL TIME FLOODED
15 DEC TO 21 DEC NO.4
15 DEC TO 28 DEC NO.5
15 DEC TO 5 JAN NO.7
15 DEC TO 12 JAN NO.8
15 DEC TO 1 FEB NO.2
4 JAN TO 1 FEB NO.9
11 JAN TO 1 FEB NO.15
18 JAN TO 1 FEB NO.12
25 JAN TO 1 FEB NO.13
15 DEC TO 1 FEB (ALTERNATE WEEKS) NO.1

Fig. 2 Average weekly infiltration rates for various treatments

. . . Recharging Ground Water

The continuously flooded plot absorbed 31 acre feet per acre or an average of approximately 4½ acre feet per acre per week. The average intake in acre feet per acre per week of flooding for all treatments was 6.4.

Summary

The experiment indicates the feasibility of replenishment irrigation of three-year old alfalfa subject to certain restrictions. Water should not be applied too late in the spring. Sufficient fall growth should be allowed before the irrigation is begun to permit the tops of the plants to remain above water. No conclusions may be drawn concerning effects of perched water tables in the root zone. Subject to these conditions, a considerable volume of water can be returned to underground storage by this method. By-products are the excellent control of weeds and the resulting improved quality of hay.

References

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3. Hall, W. A. Theoretical aspects of water spreading. AGRICULTURAL ENGINEERING 36: 394-399, June, 1955.
4. Schiff, Leonard. The status of water spreading for ground water replenishment. Trans., Am. Geophys. Union. Vol. 36: No. 6, 1009-1019.

. . . Bulk Milk Coolers

(Continued from page 97)

Power Demand and Load Factor

The relatively small motors used on the ice-bank coolers often did not require any major changes in the electric service entrance or additions to the farmstead wiring system. On some installations the wiring previously used for the can cooler was adequate. On several others a new branch circuit to the milkhouse was the only wiring required.

The low power demand of the small motors on the ice-bank cooler along with the long operating period of the condensing unit results in a good load-factor condition. Although the condensing unit normally operates during some part of the milking period, it is not needed for the cooling operation. If the voltage is low during this period, the dairy farmer can turn off the compressor. The condensing unit can also be operated on a time switch to take advantage of a low "off-peak" rate or to take advantage of the more efficient performance with the cooler air temperatures during the night. If electric demand meters are in use or demand charges in the rate schedule, serious consideration should be given to the type of cooler that can be operated durin gthe off-peak periods.

In several cases the power supplier was required to increase the size of transformer and the service to the farmstead in order to serve the large motors used on direct-expansion coolers. This might have been considered desirable in some situations in view of the existing load; in other instances, however, it would not have been necessary had a cooler with a better load factor been selected.

Equipment Disconnect Switch

All but three of the coolers in the study were installed with a disconnect switch within sight of the motor-driven equipment as required by the National Electrical Code. However, 29 switches were too small for the compressor motors. Several other installations had disconnect switches large enough for the compressor motors but not for the total horsepower of the compressor, the condenser fan, and the agitator motors combined.

Wiring Materials

Non-metallic wiring materials have been recommended for more than 20 years where moisture is present in farm buildings. Yet 64 bulk cooler installations, or 53 percent, were wired with metal-clad materials, largely conduit and electrical metallic tubing. The new plastic or neoprene-covered cables would seem to be ideally suited to the moist conditions in most milkhouses. Yet plastic cables were found in only 17 installations.

Truck Pump Motor Outlet

The three-pole 230-volt crowfoot type of receptacle with a grounding conductor for the truck-pump motor was found on 36 (30 percent) of the farms visited. The three-pole 230-volt twist-lock type of receptacle with a grounding conductor was found on 28 farms, or 23 percent of those visited. All but seven of these receptacles were rated 20 amps at 230 volts. Both types appeared to be satisfactory. The new three-pole 230-volt tandem-blade receptacle with U-type grounding terminal would appear to be better than any type found in the study (Fig. 3).

In one state the milk plant required the dairymen to purchase and install a special 230-volt, three-pole watertight receptacle rated at 30 amp. A 1-hp pump motor used on the pickup truck would normally be rated 6.5 to 7 amps at 230 volts. Most of these receptacles were installed inside the milkhouse and at a height subject to little possible effect from water. The watertight cable connector had not been specified. These receptacles were reported to have cost the dairyman nearly four times the cost of a 20-amp crowfoot type receptacle that would have been satisfactory. This expensive receptacle was a part of the farmer's own permanent wiring system, but he was unable to use it for any other 230-volt equipment without purchasing an expensive plug cap for an adapater cord. Thirty-five farms visited in this area had this special outlet for the truck-pump motor.

In three of the six states, four milk plants were attempting to operate 1-hp truck-pump motors on 115-volt power with considerable difficulty. Duplex convenience outlets and lamp holders were used for 115-volt power in these areas. One milk plant had equipped its trucks with auxiliary gasoline engines and another had purchased a new truck with a hydraulic pump driven by the PTO from the truck engine. It is entirely possible that with 230-volt power these milk plants would have experienced little difficulty with electric motor-driven pumps.

Conclusions

While few statistically significant conclusions result from this type of study, there were, however, many findings that should be corrected in the design, manufacturer, sale and installation of this expensive equipment for dairy farmers. There were far too many violations of well known nationally accepted electrical and refrigeration standards used by equipment manufacturers. The study clearly points toward the need for all agencies interested in the dairy farmer to encourage the use of nationally recognized standards by all bulk cooler manufacturers.

Following are brief reviews of papers presented at ASAE meetings or other agricultural engineering papers of which complete copies are available. Information concerning copies of these papers may be obtained by writing to the American Society of Agricultural Engineers, St. Joseph, Mich.

Effective Terrace Maintenance, by Dwight D. Smith, agricultural engineer, Eastern Soil and Water Management Section, USDA, Beltsville, Md. Presented at the Winter Meeting of ASAE in Chicago, Ill., December, 1956, on a program arranged by the Soil and Water Division. Paper No. **57-3.**

Methods and tools for plowing terraced fields, their relation to terrace maintenance and effect on the field profile are discussed. Continued use of the one-way plow is shown to result in benching of the field and an uneven distribution of top soil. With two-way plows and the selection of the proper frequency of up-slope plowing and percentage of row crops in the rotation, the up and down-slope soil movement can be balanced to produce a uniform slope for the interterrace area and a more even distribution of top soil. Terrace maintenance is accomplished without special operations.

Drain-yield Estimation for Interceptor Type Drains in Irrigated Areas of Colorado, by W. J. Frederick, soil scientist, (SCS), USDA, Court House Building, Pueblo, Colo. Presented at the winter meeting of ASAE in Chicago, Ill., December, 1956, on a program arranged by the Soil and Water Division. Paper No. **57-8.**

A method for drain yield estimation based on pumping tests along the proposed drain site developed by the Soil Conservation Service technicians in Colorado for use in irrigated areas is discussed in this paper. Based on the investigational findings of soils and ground water conditions, a series of 1¼-in holes is bored to the depth of the proposed drain along the design site. A pitcher pump, with ⅜-in suction pipe set one ft below the water level, is operated at each of the wells. The top foot of water is removed and measurements in gpm are recorded for the pumping rate at the foot draw-down level.

This pumping rate in gpm for each pump site then represents the yield of one lineal foot of drain ditch after multiplying by a conversion factor of 0.25. The total drain yield then is obtained by adding the yield estimations, section by section.

Data were obtained from drains at various locations over the State of Colorado in developing the conversion factor of 0.25 when using this method. The conversion factor is the ratio of test pump yield compared to the actual developed drain yield for a one-ft section of drain.

Automation in Barn and Feed Lot, by Roger Clay, executive vice-president, Clay Equipment Co., Cedar Falls, Iowa. Paper presented at the winter meeting of ASAE in Chicago, Ill., December, 1956, on a program arranged by the Rural Electric Division. Paper No. **57-9.**

A comparison is made between a South American Indian and a North American farmer, pointing out that the farmers in North America are still handling the animals in and around the feed lot and farm buildings much in the same manner as they were handled by their forefathers many years ago. An ideal installation for mechanically handling feed from silo to feed bunk in which 600 head of steers can be fed by one man in something less than 30 min is described. Other equipment that is now commercially available in the way of silo unloaders and mechanical feeders, self-unloading wagons, and farmer innovations of the problem are examples of the effort being made by industry as well as farmers to overcome the serious handicap with which farmers are faced.

Other means of completely and automatically handling feed from trenched silos are presented, pointing out the value of trenched silos in terms of herd size. The paper explains the importance of investment versus time and labor saved, pointing out that the investment must show a profit through a savings of labor, time, feed, or a better product.

Engineering Problems in Quality Control During Processing Operations, by Marvin Marmorine, division engineering manager, Green Giant Co., Le Sueur, Minn. Paper presented at the winter meeting of ASAE in Chicago, Ill., December, 1956, on a program arranged by the Farm Structures and Rural Electric Divisions. Paper No. **57-10.**

The subject of this paper is considered in two parts *(a)* quality measurement which is concerned with objective testing equipment and *(b)* quality control which is concerned with processing equipment.

Although all quality grading is ultimately subjective, objective tests and testing equipment have several advantages, including reproducibility of results, the elimination of the human element and lower operator skill requirement. The requirements of the industry are for machines with even better precision, that may be calibrated easily, are durable, easy to operate, and require a minimum number of standard conditions and amount of product preparation.

Processing in both field and factory consists of a series of unit operations each of which has special problems of quality control. General requirements are for machines that may be cleaned easily and can handle the product quickly and gently.

Practical Use of Knowledge About Evapotranspiration, by C. H. M. van Bavel, soil scientist, ARS, USDA, Raleigh, N. C. Presented at the winter meeting of ASAE in Chicago, Ill., December, 1956, on a program arranged by the Soil and Water Division. Paper No. **57-11.**

This paper reports that many theoretical and measurement problems remain unsolved, but there is enough knowledge about evapotranspiration to consider several possible and practical applications. When weather data can be translated into values for evapotranspiration and these, in turn, into estimates of soil moisture content, valuable studies can be made. The occurrence of drought and the size of soil moisture deficiencies can be determined by studying past weather records. This is being done on a large scale, particularly in the Southeast, and has many important applications in irrigation planning and design.

In a similar way incidence of water excess, that would apply to drainage design, and of certain conditions of trafficability can be described. In all cases results are given in terms of probability, soil conditions, geographical location and time of the year. On a current basis, the development and severity of droughts can be followed, without the necessity to measure soil moisture content. Also the correct time for irrigation may be found for use in the operation of irrigation systems. The paper points out that the limitations inherent in the applications cited seem to indicate that their usefulness is restricted to humid or semi-humid areas.

New Developments With Horizontal Silos, by Walter D. Hunnicutt, National Dairy Products Corp., New York, N. Y Presented at the winter meeting of ASAE at Chicago, Ill., December, 1956, on a program arranged by the Farm Structures Division. Paper No. **57-12.**

This paper discusses how horizontal silos fit into the new system of year around balanced forage feeding by providing large storage capacity at low capital investment and with cheap filling and feeding costs. They can be built as twins so that the new corn silage—grass-legume silage "balanced forage system" of feeding can have a silo for each kind of silage close together for ease of feeding, either on a self-feeding basis or with bunkers. They can be double decked by storing the high protein grass-legume silage in the lower portion and the corn silage in the upper portion and with extra capacity for the corn silage secured by crowning off with an up to 3-ft arch. The double-decked silages can be taken out together with a tractor fork, or kept separate for free choice feeding by slicing them out on a "stair-step" basis.

The use of an airtight, watertight, weighted-down plastic cover makes tractor fork removal for bunker feeding easy and with no spoilage of the silage face which is achieved by dropping and weighting down the plastic cover sheet over the removal face between each feeding. These feeding operations are being made easier by placing a building having several uses over the horizontal silo.

Financing of Farm Buildings, by Jack Parsons, LPG Credit Corp., Cleveland, Ohio. Presented at the winter meeting of ASAE in Chicago, Ill., 1956, on a program arranged by the Farm Structures Division. Paper No. **57-14.**

This paper states that because of the diversified knowledge that is so essential to the operation of a profit-making farm, the farmer of today is almost a corporation within himself. The requirements for successful financing of farm buildings and a new theory which incorporates a change of status of real property to take the form of a chattel, are discussed. It also highlights the differentials between metropolitan financing and rural financing. The paper explains a new concept of rural financing which gives local service on a national scale, and emphasizes the importance of expedient service on a "wet-wash basis—in by 9 out by 5," for the processing of credit applications. A broad, realistic and simplified approach to the problem of farm building financing is given.

Nominees for ASAE Vice-Presidency

LLOYD W. HURLBUT and Thomas E. Long have been selected as candidates to be placed on the ballot to fill the vacancy of vice-president of ASAE created by the death of P. T. Montfort. The unexpired term will be for two years beginning in June at the Golden Anniversary Meeting at Michigan State University and ending in June, 1959.

Lloyd W. Hurlbut, ASAE Member since 1937, was born in Sylvan Grove, Kans., February 28, 1909. He graduated from Kansas State College in 1932 with a B.S. degree in agricultural engineering and received an M.S. degree from the University of Nebraska in 1934. Following his graduation from Kansas State College he joined the staff of the agricultural engineering department at the University of Nebraska.

He served with the U.S. Navy from 1943 to 1945 as underwater sound detection officer. When he returned from his tour in the Navy he accepted a position with the agricultural engineering department at Purdue University. In 1947 he returned to the University of Nebraska as chairman of the agricultural engineering department and still holds this position.

Mr. Hurlbut has been active in ASAE, having served as chairman of the Education and Research Division; as secretary, vice-chairman, and chairman of the Midcentral Section; on the National Joint Committee on Fertilizer Application, Power and Machinery Division; Motion Picture Subcommittee; and as a member of the Inspection Committee, Region 7, accrediting program, Engineers Council for Professional Development.

He holds membership in several professional and scientific organizations including Sigma Tau, Sigma Xi, Gamma Sigma Delta, American Society of Engineering Education, Nebraska Engineering Society, Lincoln Engineers Club, and is the chairman of the Nebraska Board of Tractor Testing Engineers. He is a registered professional engineer in Nebraska.

Nominees for Vice-President

L. W. HURLBUT

T. E. LONG

Thomas E. Long is manager of the farm bureau, Portland Cement Assn. in Chicago, Ill. He was born in 1915 at Akron, Colo. He graduated from the University of Nebraska in 1939 with a B.S. degree in agricultural engineering. Following his graduation he accepted a position as assistant agricultural engineer at the North Dakota Agricultural Experiment Station doing research work in irrigation and farm structures. He was responsible for the development of an irrigation experimental research farm at Williston, N. D.

In 1944 Mr. Long became agricultural engineer with Republic Steel Corp. doing research work in the use of prefabricated steel buildings for livestock and crop storage use. He accepted his present position with the Portland Cement Assn. in 1947 and his work is concerned with the use of concrete for farm homes, farm structures, irrigation and drainage.

He became a member of ASAE in 1939, and has served as chairman of the Farm Structures Division, as secretary of the Chicago Section, and as chairman of the Farm Structures Division Steering Committee. He is a registered professional engineer in N. D.

Three Elected ASAE Fellows

THE Council of ASAE recently elected the following members to the Grade of Fellow in the Society: C. J. Allen, F. O. Bartel and E. W. Tanquary.

Charles J. Allen was born in 1877 at Moorestown, N. J. He attended Haverford College in Pennsylvania, graduating in 1900 with a B.S. degree in mechanical engineering. Immediately following graduation he joined the S. L. Allen & Co., Inc. as a machine shop apprentice. He later became a designer and draftsman in the engineering department and in 1922 was elected vice-president in charge of engineering, a position which he still holds. He has been a director of the company since 1928.

Mr. Allen has contributed to the field of agricultural engineering specifically in the development of agricultural implements for planting and cultivating vegetables. (he has 17 patents in his name, 5 are jointly shared, and one British patent). He has been a member of ASAE since 1921 and has served on the National Joint Committee on Fertilizer Application and the Committee on Garden Tractors.

Frank O. Bartel was born in Blue Earth, Minnesota in 1893. He attended the University of Notre Dame and received a B.S. degree in civil engineering in 1915. He has been engaged in agricultural engineering activities continuously since his graduation, except for a short tour as engineer in the armed forces during World War I.

Mr. Bartel was one of the early pioneers in the field of soil conservation, and he established and conducted the engineering experiments on the Federal-State Soil Erosion Experiment Station at Statesville, N. C., the results of which produced information for proper terracing methods in the Southeast. He served about twelve years with the SCS in the Southeast region as engineer in charge of flood control investigations and later as zone conservationist. He is now engaged in soil conservation and erosion control work in the U.S. Navy Department. His work with the Navy has gained new respect for the agricultural engineer among naval professional workers.

He has been an active member of ASAE since 1920 and has contributed articles relating to soil conservation for publication in the Journal.

Edwin W. Tanquary was born at Canton, Ill., in 1902. He studied mathematics and mechanical drawing in high school and after graduation he entered the pattern shop at the Canton plant of the International Harvester Co. He became interested in foundry work and studied foundry engineering by correspondence. In 1924 he was promoted to assistant foreman of the grey iron and malleable foundries, but later returned to the pattern shop as assistant foreman to assist in a program of foundry pattern modernization.

He was transferred to the enginering department in 1928 as consultant on casting design, and later assigned to tillage implement design where he served until 1938. He was promoted to the company headquarters office in Chicago and appointed engineering specialist to handle special assignments and later became staff engineer, Farm Implement Division. In 1945 he was elected chairman of the Advisory Engineering Committee of the Farm Equipment Institute where he represents his company on farm implement engineering. As representative of the Farm Equipment Institute, Mr. Tanquary represented the American farm equipment industry at a conference of the International Organization for Standardization held in 1954 at Lisbon, Portugal.

He became a member of ASAE in 1946 and has contributed to the development of many of the ASAE standards. He served as vice-chairman of the Power and Machinery Division in 1949-50, and as chairman the following year. He is presently a member of the Division's Steering Committee. He was president of the Society in 1953-54 and completed his three-year term as a member of the Council in June, 1956. In 1955 he was appointed chairman of the ASAE Finance Committee.

National Electrical Week

THE National Electrical Week will be observed February 10-16. It will be an all-industry educational and promotion event with backing being provided by network television, radio, publication advertising, and by state and local activities. The appreciation of electricity and the contributions of the electrical industry to national progress and the economy of both the United States and Canada will be stressed on programs and in publicity.

EJC Elects Officers

THE board of directors of Engineers Joint Council held a meeting in November and elected J. W. Barker as president and F. S. Black as vice-president of EJC for 1957.

Mr. Barker is presently chairman of the board of directors and president of the Research Corporation. He is a graduate of Massachusetts Institute of Technology in electrical engineering, and has served as professor at MIT and at Lehigh University, and later as dean of engineering, Columbia University. He acted as special assistant to the Secretary of the Navy from 1941-1945.

Mr. Black, publisher and editor of the *Electrical World* magazine, has been active with the American Institute of Electrical Engineers, and has been a member of the board of directors and chairman of the planning committee of Engineers Joint Council. He is a graduate of the University of North Carolina with a B.S. degree in electrical engineering and a graduate of the National University Law School with an M.S. degree in patent law.

National Dairy Engineering Conference

THE fifth annual National Dairy Engineering Conference will be held February 26-27 in the Kellogg Center at Michigan State University. The program is divided into five different parts concerning new developments in pasteurization; the use of vacuum in connection with pasteurization; packaging and filling and distribution problems; stop the experts; and plant design and maintenance.

I. J. Pflug will preside at the opening meeting on the morning of February 26. Papers will be presented on engineering principles of "no-hold" pasteurization; experiences with "no-hold" pasteurization and its use on high solids milk; principles and operation of the vacreator; high temperature vacuum pasteurization system; and an air purge device. After the noon luncheon discussions will cover the weight control of milk; plastic bags for cream; filling milk dispenser cans; refrigerated trucks for retail routes; and plastic materials for truck body, bulk tank and tanker.

Topics to be considered during the morning session, February 27, will concern architectural considerations for plant expansion, and how to specify concrete floor construction. A panel discussion called "stop the experts" will also be presented. The afternoon session will include papers on boiler safety controls; maintaining dairy walls, floors, and equipment; and the challenge ahead in dairy engineering.

Scandinavian International Machinery Exhibition

SCANDINAVIA'S first international machine-technical exhibition for agriculture, horticulture and livestock-raising, entitled "From Seed to Harvest," will be held in the St. Erik's Hall in Stockholm, Sweden, March 22-31. The exhibition will be a survey of today's agricultural machinery and chemical products in the field. Sponsors of the show are jointly the JUF (Young farmers organization) and the Periodical Tractor-Journal together with the Exhibition Inc.

ASHAE Annual Meeting

THE 63rd annual meeting of the American Society of Heating and Air-Conditioning Engineers will be held at the Conrad Hilton Hotel in Chicago, Ill., February 25-28. Further information can be obtained by writing to A. V. Hutchinson, Executive Secretary, American Society of Heating and Air-Conditioning Engineers, 62 Worth St., New York 13, N. Y.

V-Belt Education Program

THE Dayton Rubber Co. introduced a program on heavy-duty V-belts at the Pennsylvania State University Agricultural Extension School, December 11, for the 4-H leaders' clinic held in connection with machinery demonstration at the Harrisburg, Pa., farm show building.

The presentation consists of a slide-film and chart talk accompanied by a raw materials and finished product display. It takes to the farmer and farm dealer level an educational program on the proper application, maintenance and selection of agricultural V-belts. The program is designed to offer a better understanding of the value of the proper use of V-belts on combines, forage harvesters, corn pickers, balers, and other agricultural machines.

Special Exhibits Planned for Golden Anniversary Meeting

Michigan State agricultural engineering building shown above will house the extension and special exhibits to be on display during the Golden Anniversary Meeting of ASAE, June 23 to 26. In addition to extension exhibits, special exhibits will show equipment that is in the research and development stage, or equipment that is not commercially available, but expected to be available in the future. These exhibits will consist of such items as a solar battery, a solar-powered pump, solar grain drying equipment, a solar furnace and a solar mobile. A model of an atomic power plant, an air-conditioned tractor, historical exhibits of farm machinery development, fuel injection systems for farm power units and gas turbine engines, and exhibits to show foreign farm machinery developments are being planned. A modern industrial design exhibit of materials for building light, triangular-shaped frame structures, a U.S. Weather Bureau display on the formation and spotting of tornadoes and a display of historical drainage tile are only a few of the many items that will be of interest to all agricultural engineers and guests.

Nuclear Congress

THE 1957 Nuclear Congress will meet March 11-15, 1957, at convention hall in Philadelphia, Pa. This congress is coordinated by the Engineers Joint Council and will include the 2nd nuclear engineering and science conference, 3rd international atomic exposition, 5th hot laboratories and equipment conference, and 5th atomic energy in industry conference.

A nuclear congress is held to foster a free exchange of knowledge, information and ideas between engineers and scientists in all fields of technology, among leaders in industry and management, between management and engineers and scientists; and to reduce the demands on the time of individuals by bringing into one meeting the latest information and exhibits from all fields of nuclear science, engineering, and management covering creation and utilization of atomic energy for peaceful purposes.

Research and Engineering Center Planned

INTERNATIONAL Harvester Company has announced the construction of a farm equipment research and engineering center at the company's experimental farm in Hinsdale, Ill.

The new building will contain research and engineering laboratories, experimental engineering shops, office space, cafeteria, drafting and designing rooms, a dispensary, testing laboratories, a power house for heating the building, and an elevated water tower for fire protection. The entire research and engineering organization of the company's farm tractor division, a large portion of its farm implement research and engineering groups, and the engineering materials research section will be located in the new building. Completion is scheduled for the summer of 1959.

Southern Training Center

THE Ford Motor Company is establishing a training center for tractors and farm machinery sales and service personnel on a farm in Dooly County, Ga. It will be operated by personnel from the Tractor and Implement Division's sales training department which also conducts training operations at a farm near Clarkston, Mich.

An administration and classroom building, a service shop, and two equipment storage buildings were erected by mid-January, when training sessions began.

DISA Meeting

THE 38th annual meeting of the Dairy Industries Supply Association will be held at the Shoreham Hotel in Washington, D. C., March 14-15.

A business session devoted to panel discussions on the biennial Dairy Industries Exposition will follow the opening luncheon, March 14. The future of the dairy industry will be discussed during the morning session on March 15 by a leading dairy processor, after which association business will be conducted. The concluding session will be a luncheon featuring a talk on the policies of the present administration as they affect the dairy industries.

Industrial Waste Conference

THE Purdue Industrial Waste Conference will be held May 13, 14, and 15 in the Purdue Memorial Union Building at Purdue University, Lafayette, Ind. Papers will be presented on subjects dealing with industrial wastes and their treatment

Hotel reservations can be made at the Purdue Union Club, Fowler Hotel, Cedar Crest Hotel and Morris Bryant Hotel. Registration blanks will be mailed upon request to Don E. Bloodgood, School of Civil Engineering, Purdue University, Lafayette, Ind.

L. M. K. Boelter, dean of engineering, University of California, Los Angeles, received the Lamme Award for 1956, given by the American Society of Engineering Education, for "his work in the field of thermodynamics and heat and mass transfer, his efforts toward a reconciliation of the great areas of common interest in engineering education, his inspirational teaching of the principles of engineering, and for his civic interests and professional contributions."

Mr. Boelter was born in Winona, Minn., in 1898. He is an alumnus of the University of California having earned a B.S. degree in mechanical engineering in 1917 and an M.S. degree in electrical engineering in 1918. After graduation he joined the faculty as instructor in electrical engineering and remained there until 1934 when he accepted a position as agricultural engineer at the Agricultural Experiment Station, University of California, Davis. In 1941 he became associate dean of the College of Engineering of the University of California at Berkeley and three years later professor of engineering and dean of the College of Engineering at the University of California at Los Angeles.

He has been a member of ASAE since 1942. He has been a leader in the effort to bring about a reconciliation of the areas of common interest in the various branches of engineering.

Edward R. Gross, formerly head of the agricultural engineering department at Rutgers University, writes that he is now secretary of the Township of North Brunswick Planning Board, Middlesex County, New Jersey. His office is located in the Municipal Building, 4 Linwood Place, North Brunswick, a suburb of New Brunswick.

Roger A. Miller joined the staff at Ohio State University as an extension agricultural engineer specializing in farm housing. Formerly he was district engineer at Cornell University, Ithaca, N. Y.

Roy Winkle has been transferred from the Lancaster SCS office to area engineer at Warren, Ohio.

E. W. Lehmann (Fellow ASAE) was named chairman of the Farm Safety Congress at the recent National Safety Congress and Exposition in Chicago. He is professor emeritus of the agricultural engineering dept. at the University of Illinois, and special representative to the vice-president of the farm implement division for International Harvester Co.

Allen K. Gillette recently received an M.S. degree in agricultural engineering from Michigan State University and has accepted a position as chief engineer of the dairy division for Perfection Mfg. Corp. at Belvidere, Ill. Prior to returning to MSU for further study toward an M.S. degree, Mr. Gillette was associated with the Detroit Edison Co. for five years as farm service advisor.

★

MERRITT D. HILL

D. W. RICHTER

★

Merritt D. Hill has been appointed as general manager of the Tractor and Implement Div. of Ford Motor Co., Birmingham, Mich. Formerly assistant general manager of the Division he succeeds **Irving A. Duffy,** who has been appointed to the position of group vice-president. Mr. Duffy had been Division general manager since 1954. He will now have responsibility for the operations of six divisions of the Company.

Mr. Hill started early in the farm equipment business. As a boy of 12, he assisted his father, a farm equipment dealer, in delivering and assembling new farm equipment on customers' farms. Since that time he has had a lifetime of sales and merchandising experience. He was affiliated with General Motors for 12 years as sales manager of the Delco Battery Div., and later general merchandising manager of United Motor Service. In 1947 he joined the Dearborn Motors Corp. as general sales manager and was named vice-president and a member of the board of directors in 1950.

In 1953 he joined Ford Motor Co. and served as assistant general manager until his recent appointment. He was born in Pontiac, Mich., and is a graduate of the University of Detroit.

Donald W. Richter has been appointed sales engineer in charge of marketing prefabricated steel agricultural buildings for Armco Drainage & Metal Products, Inc., a subsidiary of Armco Steel Corp., Middletown, Ohio.

He joined Armco in 1953 as a marketing specialist in charge of the agricultural markets section of the market development division shortly after receiving a Ph.D. degree in agricultural engineering from Cornell University.

Ralph U. Blasingame (past-president of ASAE, 1936-37) who retired some years ago as head of the agricultural engineering department of Pennsylvania State University, and who for a few years more recently carried out a special assignment as an agricultural engineering consultant to the Puerto Rico Agricultural Experiment Station, writes that he is now engaged as a consultant at the Alaska Agricultural Experiment Station at Palmer, Alaska. He highly recommends to any young agricultural engineer, who may be given an opportunity to undertake an assignment in Alaska, that he seriously considers accepting it.

NECROLOGY

George V. Dow, executive engineer at the John Deere Waterloo Tractor Works in Waterloo, Iowa, died of a heart attack, October 26, while he and Mrs. Dow were attending the annual dinner party of the Deere engineers and their wives. Mr. Dow was the principal speaker at the dinner.

He was born in 1912 at Sheffield, Iowa. He attended Iowa State College, Ames, graduating in 1933 with a B.S. degree in mechanical engineering. Immediately following graduation he accepted employment with the John Deere Waterloo Tractor Works and worked for them up until the time of his death except for two years service in the U. S. Army during World War II.

Mr. Dow was a member of the Society of Automotive Engineers, the Waterloo Technical Society, the Kiwanis Club, the Methodist Church and was active in Boy Scout work. He joined ASAE in 1955.

J. E. Badley, president of Tractor Training Service in Portland, Oregon, died on June 19, 1956.

He was born in Meridian, Idaho in 1899. He attended Oregon State College and specialized in agricultural engineering. From 1919 to 1922 he worked first as mechanic and later as field service man servicing agricultural machines and implements for the Alexander-Badley Co. in Portland.

The following year he was service manager throughout western United States for Bear Tractors, Inc. of New York City. In 1924 he formed the Badley Truck Co. in Portland, Ore., as truck distributors for the states of Oregon, Washington and Idaho. He served as western staff member for the Caterpillar Tractor Co. from 1929 until 1931. The following year he became president of Angleworm Tractor Co., responsible for design, production and distribution of a small 10-hp farm tractor. In 1938 he became president of Tractor Training Service for training men as tractor engineers. He held this position until his death.

Roy M. Magnuson, founder of Magnuson Engineers, Inc., San Jose specialists in fruit and vegetable processing machines, died in a San Jose hospital December 12, after a week's illness.

Mr. Magnuson, former president of the firm bearing his name, started the business in 1942, after being employed by Food Machinery and Chemical Corp. In addition to new designs in fruit and vegetable machinery, he is noted for perfecting a method and equipment for fighting fire by means of high pressure water fog.

He and his firm are particularly well-known for their advanced equipment and ideas for tomato processing. In 1947 Mr. Magnuson visited Jamaica to help that area set up its first major tomato cannery. He started his career as an apprentice draftsman for the Samson Tractor Division of General Motors. He moved to San Jose in 1930, as chief engineer for a Stockton Pump Co. He had been a member of ASAE since 1938.

Reports from Local Sections

Items used in this column must be received by the 20th of the month preceding publication date

Pennsylvania Section

The meeting of the Pennsylvania Section was held October 18-19 at the Beachcomber Hotel in Erie. Topics that were presented on October 18 were on potato harvesting and storage, frost control with irrigation, marketing problems in Northwest Pennsylvania, the heat pump in Pennsylvania, and ethics of engineering. A buffet dinner was served after which J. L. Butt, National Secretary of ASAE, spoke. Later, group discussions in the fields of machinery, water and soil, structures, and rural electrification were held.

Friday morning, October 19, was devoted to a business meeting and short talks on grassland farming by local farmers. Other topics presented were on new research in hay drying, latest trends in wagon drying, preventative maintenance of silos and trends in forage harvesting equipment.

The meeting closed with tours to Welch's grape juice plant, a modern dairy farm, and the locomotive division of the General Electric Co. in Erie.

Michigan Section

The Michigan Section held a meeting February 9 at the Tractor and Implement Division of the Ford Motor Co., Birmingham, Mich. The morning began with registration after which two concurrent programs were scheduled. Papers were presented on a third dimension in farm chores by M. L. Esmay, and organize the farmstead for more profit by Louis Webb during the session presided over by R. C. Frevik, Section vice-chairman. R. J. Alpers, Section chairman, presided during the program at which a paper on agricultural drainage developments by Virgil Overholt was discussed. A tour of the Tractor and Implement Division Evaluation Center concluded the morning program.

Luncheon was served in the Tractor and Implement Division Cafeteria and agricultural engineering students were guests of the Ford Tractor and Implement Division. A business meeting followed with R. J. Alpers presiding. "Modern power plants" was the theme of the afternoon session and papers were presented on reciprocal piston engine by Louis L. Otto, MSU mechanical engineering dept.; high compression and fuel injection by Max Roensk director, Chevrolet Engineering Laboratory; free piston engine by Louis L. Otto; and the gas turbine engine by L. T. Alpers, sales engineer, Boeing Airplane Co., Seattle, Wash. Dale L. Roeder presided.

ASAE Meetings Calendar

February 16 — OHIO SECTION, Elks Club, Findlay, Ohio

March 1-2 — NORTH CAROLINA SECTION, place not announced.

March 28 and 29 — SOUTHWEST SECTION, College Station, Texas

March 29-30 — MID-CENTRAL SECTION, Hotel Robidoux, St. Joseph, Mo.

April 5-6 — ROCKY MOUNTAIN SECTION, University of Wyoming, Laramie

April 24 — MICHIGAN SECTION, Howell Boy Scout Camp, Brighton, Mich.

April 26-27 — FLORIDA SECTION, Lakeland, Fla.

June 23-26 — GOLDEN ANNIVERSARY ANNUAL MEETING, Michigan State University, East Lansing

December 15-18—WINTER MEETING, Edgewater Beach Hotel, Chicago, Ill.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

Alabama Section

The Alabama State Section held a meeting October 11-12 at Winfield, Ala. with approximately 50 in attendance. The first day consisted of registration, a tour of the Upper Coastal Plains Substation, and a banquet in the evening with Senator Albert Davis of Aliceville as the speaker.

During the morning session on Friday, October 12, papers were presented on new innovations in building construction, by Walter Grub; small watershed work under Public Law 566, by Sam Richburg; pressure measurements under tractor and implement tires, by A. W. Cooper; and on the heat pump—today and tomorrow, by C. W. Cheatham. The meeting closed with a business session at 11:00 a.m. Joe Hixon, vice-chairman of the Alabama Section presided.

Ohio Section

A meeting of the Ohio Section will be held February 16 at the Elks Club in Findlay, Ohio. The morning program will cover a tour of the Hancock Brick and Tile Co. plant, and the presentation of a paper on engineering problems involved in the manufacture of draintile by James L. Child, Jr., Hancock Brick and Tile Co.

During the afternoon session H. H. Morse, SCS, will discuss soil and water conservation practices needed in Ohio, and G. O. Schwab, agricultural engineering department, Ohio State University, will present a paper on equipment requirements for conservation farming. A symposium on proposed changes in the Ohio ditch laws is also scheduled. The panel members will be Guy Neeper, county engineer; John Sims, Ohio Farm Bureau Federation, and Virgil Overholt, Hancock Brick and Tile Co. The session will close with a business meeting.

Mid-Central Section

A meeting of the Mid-Central Section will be held in Hotel Robidoux at St. Joseph, Mo., March 29-30. A program is being planned which will contain papers of interest to all who have a broad interest in agricultural engineering. Each of the four agricultural engineering departments represented in the Mid-Central Section, Iowa, Nebraska, Kansas and Missouri, will be asked to have a staff member present a 15-minute discussion of some significant research program in progress. Extension representatives from each state will describe the extension programs actively being promoted. An industry representative from each state will present a subject of interest in the commercial field.

(Above) A corps of Ford engineers served as host members to the Michigan Section of ASAE during a meeting held at the Tractor and Implement Division, Ford Motor Co. in Birmingham, February 9. *(Left to right)* C. B. Richey, chairman, Steering Committee of ASAE Power and Machinery Division and research engineer, general engineering dept.; D. F. Kampe, member of Section publicity committee; R. C. Frevik, Section vice-chairman; Dale Roeder, chief engineer, and R. J. Miller, manager, general engineering dept.

(Right) The executive committee of the North Atlantic Section met November 9 in Boston to discuss plans for the 1957 Section meeting. An invitation to hold the meeting on the campus of the University of Delaware has been accepted. *(Left to right)* B. L. Bondurant, vice-chairman; Arthur G. Fox, secretary-treasurer; Herbert N. Stapleton, chairman; and Merle S. Klinck, junior past-chairman

New Tractor Line

International Harvester Co. has announced a new line of 10 farm and industrial wheel tractors. The tractors are identified by a new, two-tone red and white color, new model designations, new features, and increased horsepower in most models. Farm tractors in the new line are the 1-plow Farmall Cub, the 1 and 2-plow Farmall 130, the Farmall 230 in the 2-plow class, the

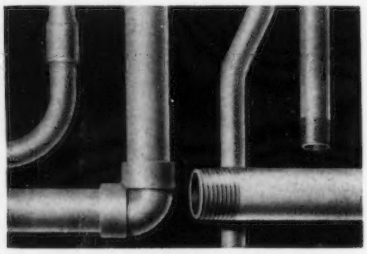
Farmall 350 and International 350 Utility in the 3-plow field, the Farmall 450 and International W-450 in the 4 or 5-plow size and the International 650 in the 5 and 6-plow size.

Increased horsepower, more precision control of hydraulically operated implements, power adjusted rear wheels, and a new hitch with traction control are features of the new models. A complete story of the new hitch appears in this issue.

(For more facts circle No. 86 on reply card)

Extends Pipe Size Range

Easton Plastic Products Co., Inc., Easton, Pa., has extended its pipe size range of rigid (unplasticized) PVC pipe to include all standard pipe sizes from ¼ to 6-in. In irrigation the pipe is said to resist corrosion



and electrolytic attack in any soil. According to the manufacturer, it has been approved by the National Sanitation Foundation for use with drinking water, and is finding increased use as protection for underground telephone and electric wiring.

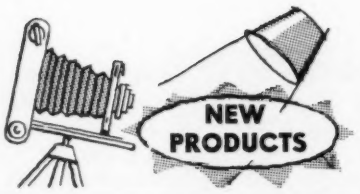
(For more facts circle No. 100 on reply card)

New Six-Plow Tractor

J. I. Case Co., Racine, Wis., has announced a new six-plow, six-speed, six-cylinder Model 600 tractor. New fast power steer-

ing, dual-control hydraulic system, independent power take-off and declutchable belt pulley are features of the new model. Diesel or LP-gas engines are available in standard and Rice Special models.

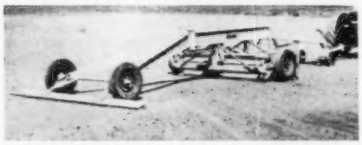
(For more facts circle No. 85 on reply card)



Combination Leveler, Scraper and Tillage Tool

The Eversman Mfg. Co., has announced a new combination automatic land leveler, open bottom hydraulic scraper and tillage tool for seedbed preparation. The new model is 32 ft, 6 in long and 12 ft wide, weighs 2010 lb, has 1¾ cu yd dirt capacity and pulls with a 3-plow tractor.

Improvements in the crank axle design have been made in the new model. The main wheels have been moved farther ahead of the blade. As a result the blade lowers at



an earlier point on the high spots and starts to cut sooner. This action will eliminate the long shallow ridges. The blade raises to dump earlier resulting in overfilling of low spots to allow for dirt settlement. Also, the new crank axle design alters the relationship between the tension springs and the movement of the main wheels so that greater weight of the machine is transferred to the cutting edge and less weight remains on the main wheels during a cut.

(For more facts circle No. 84 on reply card)

Improved Electronic Timer

General Control Co., 367 Boylston, Boston, Mass., has announced improvements in its type ET, electronic timer. Changes include an improved line of matched industrial housings for various mounting conditions. In the case of the boxed, sheet-metal housing, type ETH, the front of the enclosure has been split to permit access to the terminals for fast wiring changes. Other

changes include the slide-out chassis with plug-in tube and condenser.

The ET timer is designed to control timed operations between 60 milliseconds and 60 seconds, and is adjustable to any fraction of this range. It has readily accessible terminals, isolated load contacts, and a large, easy-to-read dial. It is available in 115 or 220-volt, a-c, 60-cycle models. Write for bulletin ET-600 for additional information.

(For more facts circle No. 93 on reply card)

Introduces Tractor Loader

New Idea Farm Equipment Co., Coldwater, Ohio, has introduced a new hydraulic loader designed for use with row crop and adjustable front axle tractors. Mounting brackets, hose and trip lever support vary on some tractor models, requiring minimum dealer inventories, it is said.

Three mounting points for cylinders give a selection of lifting heights and capacities. The manufacturer reports that double-acting hydraulic cylinders, except on Allis-Chalmers WD and WD-45 tractors, serve as their own oil reservoir and no extra supply tanks are needed. Single-acting cylinders are used on A-C tractors.

The new loader has a lift capacity to full height of 2,000 to 2,400 lb, depending on the hydraulic system, with an additional 25 percent breakaway capacity. At the present time, the new loader fits the Allis-Chalmers WD and WD-45, Deere 50, 60 and 70, and Farmall 300 and 400 tractors. The company reports that the loader will fit other tractors soon.

(For more facts circle No. 94 on reply card)

Salinity and Fertilizer Soil Tester

Industrial Instruments, Inc., Cedar Grove, N. J., has introduced an instrument to measure the amount of soil fertilizer or soil salinity by the soil extract method. The instrument is said to be especially advantageous where it is necessary to make tests on a large number of soil samples. It is adapted for laboratory rather than field test-

ing, in general. A soil extract is made by placing air-dry screened soil and some distilled water in a flask and occasionally shaking. After 30 min, the suspension is filtered through a glass funnel and filter paper. The clear or slightly cloudy filtrate is reserved for measurement.

The bridge is an a-c Wheatstone Bridge, which reads directly in terms of the conventional "K" factor. A built-in manual temperature compensator is said to eliminate the need for calculations.

(For more facts circle No. 92 on reply card)

(Continued on page 114)

WHEN YOU'RE DESIGNING FOR LOWER COST...

...specify from the

BIG FIVE

If your implement design problem involves cost reduction, you'll find your answer in the CHAIN Belt Big Five—the five basic types of implement chains that provide the answers to any need.

Consider, for example, Rex® Series CA Conveyor Chain. This chain is basically similar in appearance and application to ASA double-pitch roller chain. Its cost is substantially less. A matching drive series is also available in this basic type—Series A.

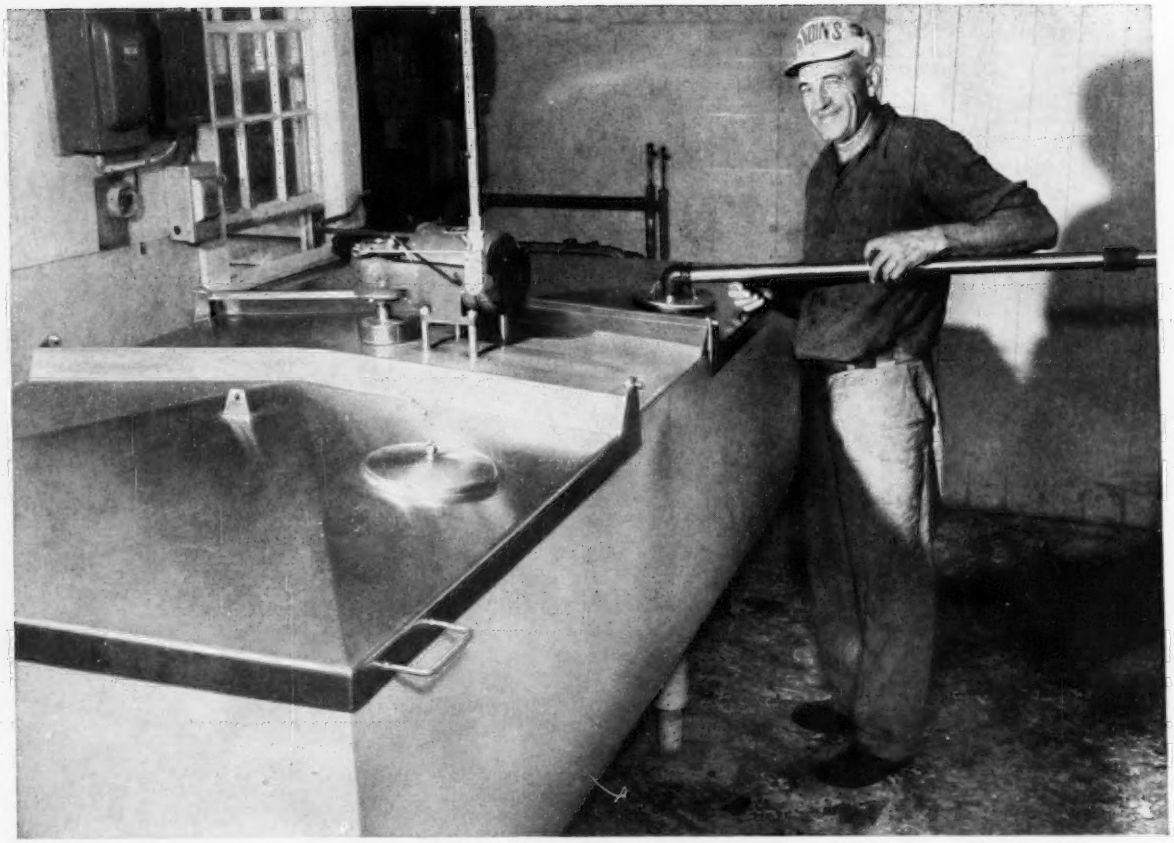
Your Chain Belt District Sales Engineer is trained to help you in selecting the chain that best fits your design—the chain that will give you at lowest cost the reliability of service which your application demands. Call him today or write CHAIN Belt Company, 4680 West Greenfield Avenue, Milwaukee 1, Wisconsin.

Steel detachable chain | HF steel detachable chain | Series A and CA double-pitch roller chain | Series AR rollerless chain | ASA double-pitch roller chain

CHAIN BELT COMPANY

Milwaukee 1, Wisconsin

For more facts circle No. 48 on reply card



Stainless Steel Helps Farmers solve the work and sanitation problem of handling many small cans every day. Stainless steel tanks like that shown above make the bulk milk system practical. They permit storing milk for two days without danger of contamination from the metal. Yet they are easy to clean despite the 2-day storage. This tank holds milk at 35°F. Transferring milk from tank to pick-up truck takes about 10 minutes at the Braley farm, Bangor, Maine.

Farmers protect purity of milk and save work by using stainless steel tanks

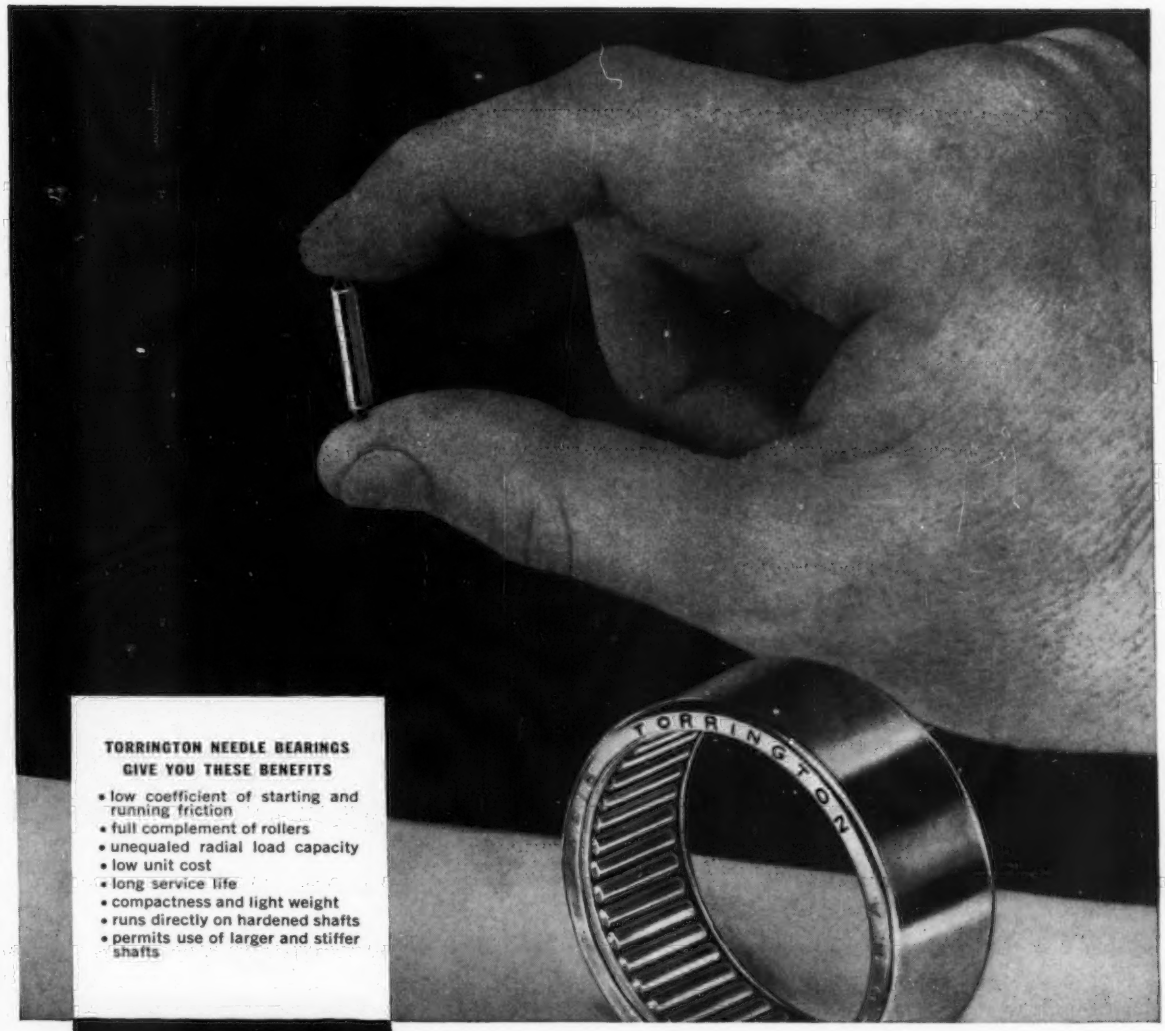
Here's a 500-gallon chromium-nickel stainless steel tank that brings several advantages to Ernest Braley, owner of 40 Holsteins.

First, purity of milk is protected because stainless chromium-nickel steel resists attacks by food acids, steam, water, atmosphere and also by cleaning solutions. Thus, no corrosion products are given off that may affect either purity or flavor of the milk. Moreover, the dense surface of chromium-nickel stainless can be readily polished to a smooth finish which offers no harbor for bacteria or other contaminants.

And, this tough, rugged metal is easy to clean and keep *hygienically* clean. Unlike metals that corrode and pit, stainless steel saves the dairy farmer considerable work. His routine scrubbing, washing and rinsing take less effort. And less time.

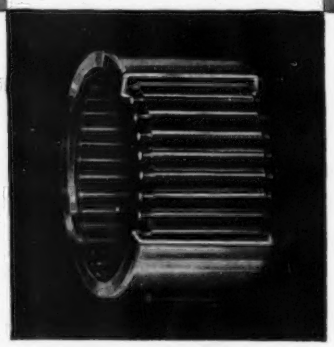
Stainless steel is not only a sanitary metal, it's also a tough metal that stands rough usage. Even abuse. So start using it now for dairy and allied equipment. Leading steel companies produce austenitic chromium-nickel stainless steels in all commercial forms. We'll be glad to help you select exactly the right type of stainless for your specific needs. Send us details of your application for our suggestions.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N. Y.



TORRINGTON NEEDLE BEARINGS GIVE YOU THESE BENEFITS

- low coefficient of starting and running friction
- full complement of rollers
- unequaled radial load capacity
- low unit cost
- long service life
- compactness and light weight
- runs directly on hardened shafts
- permits use of larger and stiffer shafts



Close-up of precision!

This Needle Roller, key to the operation of the Torrington Needle Bearing, is a microscopically precise example of Torrington craftsmanship.

In every manufacturing step, from selection of bearing materials to final polishing, these rollers are checked with strict quality control.

A full complement of rollers, mounted in a precision-made, case-hardened retaining shell, provides a maximum number of contact lines, giving the Torrington Needle Bearing a higher radial load capacity than any other anti-friction bearing of comparable size. Rollers operate smoothly with low coefficient of starting and running friction.

Torrington's experience with Needle Bearings spans the history of their development for thousands of successful applications. In seeing that you get every last ounce of performance these unique bearings can deliver, your Torrington representative is an expert: call on him at any time. *The Torrington Company*, Torrington, Conn.; South Bend 21, Ind.

TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

NEEDLE ROLLERS • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • NEEDLE • BALL • THRUST

3-way forage harvester!

Versatile new self-propelled unit is driven by TDA® transmission-and-axle!

The self-propelled forage harvester you see here is something new in the farm implement field. Equipped with 3 basic attachments, this single piece of equipment will harvest all types of forage crops from corn to grasses or legumes, whether row or broadcast, standing or windrowed.

When the time came to design a special combination transmission and axle for this new harvester, the manufacturer called on Timken-Detroit®—the world's leader in the axle field.

TDA's engineers agreed with the manufacturer that the design of this special driving assembly presented some special problems. But as it turned out, they found they had solved practically the same problems for another manufacturer in a related field. So, by modifying an existing design, they were able to meet the specifications of the new forage harvester exactly—and at substantial savings, both in time and in development and manufacturing costs.

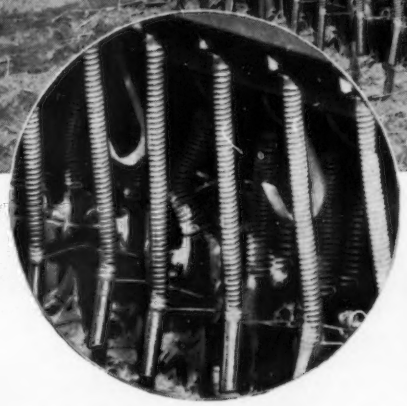
This is a typical example of TDA's experience in producing drive assemblies for the farm implement field. If you have a problem in designing or building farm equipment, remember, you can always depend on TDA's long experience and vast manufacturing facilities to get the job done right and at low cost. Your inquiries are welcomed.

TIMKEN Detroit AXLES
TIMKEN-DETROIT AXLE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
DETROIT 32, MICHIGAN
The Accepted TDA Standard

Plants at: Detroit, Michigan • Oshkosh, Wisconsin
Utica, New York • Ashtabula, Kenton and Newark, Ohio
New Castle, Pa.

©1956, R S & A Company

TDA driving mechanism for self-propelled 3-way forage harvester



Allis-Chalmers Stretches Farm Dollars with Thermoid Rubber Products

On "ALL-CROP" Drills, built by Allis-Chalmers, with *Thermoid Band Seeders* attached, farmers save up to 50% on seed costs, and get 28% more yield. Accurate seed placement *behind* the disc openers insures close-to-surface germination. Increased yields of hardier, more drought-resistant grasses and legumes have been reported—in many cases at savings of more than $5.00 an acre on seed costs alone! And, by using this method, fertilizer feeds the seeds—not the weeds!

"ALL-CROP" Drills also feature *Thermoid Fertilizer Hose*, with an exclusive, extremely flexible design that won't collapse from wear or clog from corrosion. Tests prove Thermoid Fertilizer Hose lasts three times longer than steel tubes. Chemicals corrode steel but not rubber! Along with the Band Seeder, the hose assures efficient use of fertilizer.

Bandseeding is a must for better grassland farming. Rubber fertilizer hose is a must for trouble-free service on fertilizer drills. Write to us for complete details.

Stretch farm dollars with Thermoid Rubber

Thermoid

Farm Products Division
Thermoid Co., Trenton, N.J.

Sliding bar makes hitching easy

✻ SLIDING BAR HITCH

It slides in and out about 3 feet, making hitch easy. And Marfak lubricant cushions and eases the punishing blows on bearings in field work . . . Marfak won't wash off, drip out, dry out or cake up. Arnold Karrels (right) demonstrates hitch to Jack Wilson, Texaco Distributor of Fredonia, Wis.

ARNOLD KARRELS who farms 235 acres near Fredonia, Wis., had trouble hitching a wagon to his forage harvester so he invented a sliding bar hitch which he put together with a welder. Bar is held at maximum length by a logging chain. Now hitching is easy.

Mr. Karrels, like keen farmers from coast-to-coast, has found that *it pays to farm with Texaco products.* He gets dependable service from Texaco Distributor, Jack Wilson, of the Fredonia-Belgium Oil Co.

NEIGHBORLY MEETING: "Advanced Custom-Made Havoline Motor Oil keeps tractor engines cleaner, thus delivering full draw bar power," says R. E. Stafford (right), Texaco Consignee of Waycross, Ga. Mack Carter (left) of Blackshear, Ga., Dodge dealer, and farmers J. C. Blalock (leather jacket) and J. D. Lowman of Mershon, Ga., are interested listeners.

SPECIAL DELIVERY: Bert Viar (left), who farms 500 acres near Lenox, Tenn., uses Texaco Fire Chief gasoline because it gives superior Fire-Power for low cost operation. Texaco Consignee Jerry Hindman (right) of Dyersburg, provides timely service with the delivery of a new Firestone truck tire, held by Guy Childress (center).

IN TOWN OR ON HIGHWAYS in all 48 states, Texaco Dealers will serve you with famous Sky Chief gasoline, supercharged with Petrox, to give maximum power and reduce engine wear . . . famous Fire Chief at the *regular* gasoline price, both 100% Climate-Controlled . . . Advanced Custom-Made Havoline Motor Oil and Marfak Lubricant.

ON FARM AND HIGHWAY IT PAYS TO USE **TEXACO PRODUCTS**

DIVISION OFFICES: Atlanta, Ga.; Boston 16, Mass.; Buffalo 9, N. Y.; Butte, Mont.; Chicago 4, Ill.; Dallas 2, Tex.; Denver 3, Colo.; Houston 2, Tex.; Indianapolis 1, Ind.; Los Angeles 15, Calif.; Minneapolis 3, Minn.; New Orleans 16, La.; New York 17, N. Y.; Norfolk 10, Va.; Seattle 1, Wash.

Texaco Products are also distributed in Canada, Latin America, and Africa.

TUNE IN . . . Metropolitan Opera radio broadcasts every Saturday afternoon. See newspaper for time and station.

THE TEXAS COMPANY

Try a '57 IH tractor . . . see how it gives you

POWER
put to
BETTER USE

Relax in the seat of a new, more powerful IH tractor! See how everything you touch puts power to better use! See how you power-away hard work and high costs that used to wear you out and waste your time and money.

New increased power—in seven of 10 new IH tractors—gives more snap and go . . . greater reserve power.

New Fast-Hitch with Traction-Control gives you traction that grows with the load! Handy lever lets you match range of weight transfer to *all* soil conditions—practically ends need for wheel weights.

New diesel models . . . new power spaced wheels . . . new feather-action Hydra-Touch® hydraulics—these are typical IH advancements for '57.

Choose from "America's top ten"—to fit your needs exactly! "Models unlimited" with dozens of options.

5 NEW FARMALL® tractors

5 NEW INTERNATIONAL® tractors

1 TO 6-PLOW SIZES

"MODELS UNLIMITED"

New McCormick® Farmall 450! This 4-5-plow tractor has increased power, new Fast-Hitch with Traction-Control, improved Hydra-Touch hydraulics and other new 1957 features.

Your IH dealer will gladly demonstrate power put to better use. See and try the Farmall or International tractor built to bring you far greater farming efficiency!

SEE YOUR

INTERNATIONAL HARVESTER DEALER

International Harvester products pay for themselves in use—McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois

See the IH Power Line for '57 at your IH dealer

Try the latest features—test-drive the model that fits your needs!

For more facts circle No. 28 on reply card

. . . New Products

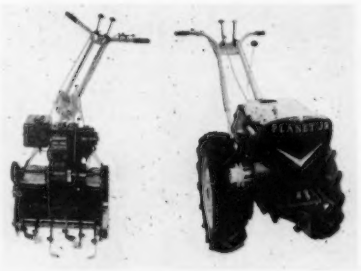
(Continued from page 106)

New Garden Power Units

S. L. Allen & Co., Inc., Philadelphia, Pa., have introduced new features in two newly-developed garden-type power units, designated as the Super Planetiller and the B8G walking tractor.

The tiller unit reportedly combines two ground working jobs into one operation. The two-in-one operation is achieved by the location of a 14½-in roller behind eight, large-size tempered 12-in tines. As the unit is operated it first tills the ground and then with the roller performs the additional function of pressing down the tilth as a second preparatory step to seeding and fertilizing.

Another new and practical feature of the tiller is its offset handles which can be set and secured in angled positions to the right or left of the conventional straight-back handle line. In operation it permits the operator to walk on either side of the unit instead of directly behind it, thus preventing tramping of the newly tilled and rolled ground. The offset handles also make it easy to use the tiller in hard-to-get areas around shrubs and trees and close to a building line.



Ease and versatility of operation is stressed also in the new walking tractor. It has an automotive type gear shift lever controlling the use of its three forward and one reverse speeds. The gear shift lever made in an extra long length is easily reached from the operator's normal position in back of the unit.

In addition to the regular rear hitch it has been fitted with a newly-designed quick front hitch for attachments including mowers, tiller, saw attachment and a dirt grader and snow plow. Attachments that have to be power driven can be connected to either one of two power take-offs, one driven at engine speed and the other at one-sixth engine speed.

(For more facts circle No. 2 on reply card)

LP-Gas and Three Front Options

The Tractor and Implement Div. of Ford Motor Co., has announced the availability of three optional front wheel arrangements for its row crop tractors, and LP-gas engines as factory installed optional equipment on

all tractor models. The front end options include single-wheel tricycle, dual-wheel tricycle or adjustable front axle four-wheel.

The single-wheel tricycle front end uses a "C" axle support and the dual-wheel tricycle option employs a one-piece pedestal with integral gears. The wide adjustable front axle permits spacing the front wheels from 52 to 76 in, and up to 80 in with the wheels reversed.

(For more facts circle No. 3 on reply card)

Expands Planter Line

Deere & Co. has expanded its line of planters to four models—the 23-B, 23-C, 23-R, and 23-F. The 23-B and 23-R unit planters attach to any 1¾ to 2¼-in square tool bar. Each unit planter is a one-row, self-contained drill-type planter. Multiple units can be used.

The 23-C and 23-F unit planters attach directly to cultivator frames. The 23-C is a two-row planter that attaches to a rear-mounted cultivator. The 23-F mounts on two-row, front-mounted cultivators for tricycle-type tractors.

(For more facts circle No. 83 on reply card)

(Continued on page 116)

No *ordinary* cooling system could have done it! To help make Wisconsin Engines first choice everywhere, it took a *special* system with these *finer points.*

- A high-capacity fan, integrally cast with flywheel, pushes more air through engine.
- Time-engineered, time-tested cooling fin design integrally cast in cylinder blocks and heads.
- Scientifically designed and placed air shrouding, providing correct heat dissipation.

The result . . . trouble-free operation, sub-zero to 140° temperatures. Write for S198 . . . handy service map and list of approved service stations.

Air Cooling

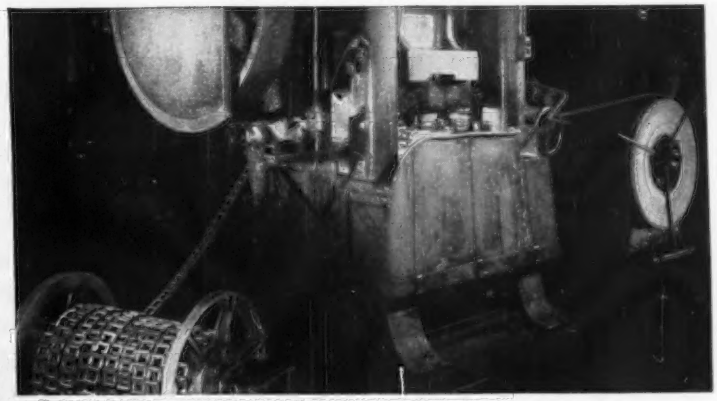
...another reason why WISCONSIN ENGINES rank 1st in the world, 3 to 36 hp.

WISCONSIN MOTOR CORPORATION
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

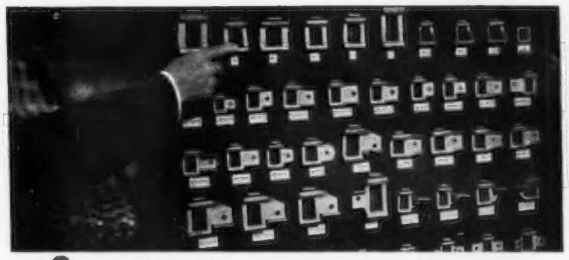
Better Performance Depends on Better Features....

For more facts circle No. 56 on reply card A-6-6050—½1

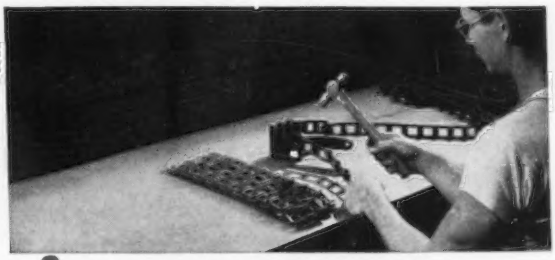
The story of long-lived STEEL LINK-BELT



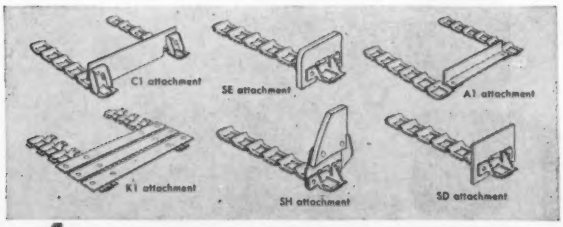
1. SPECIAL-ANALYSIS STRIP STEEL — tempered by heat treatment for precise combination of strength and wear resistance—is cut and formed into Steel Link-Belt by progressive dies. Rigid laboratory control maintains quality through every phase from raw material to finished steel.



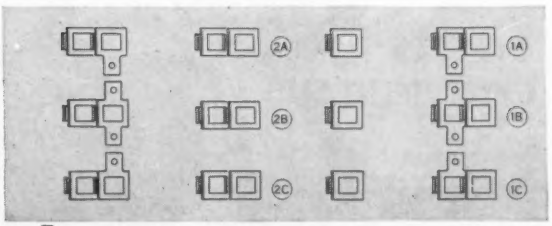
2. 22 STOCK SIZES — The complete line of Steel Link-Belt chain for light drive, conveying and elevating service gives you the right chain for maximum life on each job.



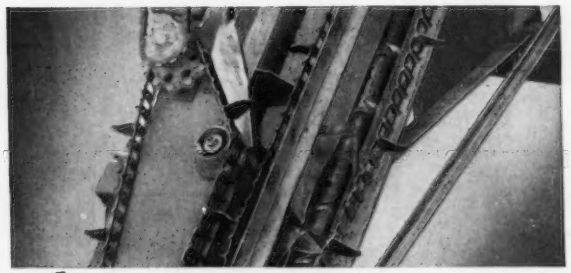
3. EASY COUPLING AND UNCOUPLING IN FIELD (or factory) are assured by hook design. Correct relation between hook opening and end bar prevents uncoupling during service.



4. 65 ONE-PIECE AND WELDED ATTACHMENTS permit economical adaptation of Steel Link-Belt to almost any conveying or elevating job.



5. FOR EQUAL LOAD DISTRIBUTION, multi-strand chains are first pre-loaded at factory to assure accurate alignment and attachment spacing. Tags, as shown above, are attached to each strand. Matched sets are coiled and wired.



6. UNEQUALLED APPLICATION EXPERIENCE ASSURES THE RIGHT RECOMMENDATION — Our engineers work with manufacturers in field tests, analyze their problems, interpret their exact requirements. For the complete long-life story of Steel Link-Belt, get Book 2403 from your nearest Link-Belt Office.

LINK-BELT

THE SYMBOL OF QUALITY — LB — LINK-BELT

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 14,253

For more facts circle No. 43 on reply card

. . . New Products

(Continued from page 114)

Mower-Crusher Hay Conditioner

New Holland Machine Co., New Holland, Pa., has developed a smooth-roll mower-crusher that is said to condition hay so that it dries in almost half the time and retains more of its food value.

The new unit rolls across fields at speeds up to 7 mph, combining two operations. Crushing is accomplished with smooth rollers that crack stems lengthwise. Stems that go through sideways are said to be crushed just as effectively as those entering lengthwise.

The dual-purpose unit is completely controlled from the tractor seat. A single

hydraulic cylinder raises and lowers the cutter bar and crusher pickup. A rope control operates the pickup independently. The crushed section attaches to any of the Model 40 series mowers or comes separately. In combination, the crusher conditions that swath mowed on the previous round while the mower is cutting a new swath.

(For more facts circle No. 95 on reply card)

Adds 95-Bu PTO Spreader

New Idea Farm Equipment Co., Coldwater, Ohio, has added a new 95-bu PTO-driven manure spreader, increasing its line to five different models. The new No. 200 spreader carries a full-year guarantee. It incorporates most of the features found in the 125-bu PTO model, including the heavy-duty power train. Also it has the entire major drive mechanism—throw-out clutch, beveled drive gears and cam—concentrated inside an oil-filled dirt-free housing. Protecting the entire spreading mechanism is a torque-limiting, disk-type overload slip clutch.

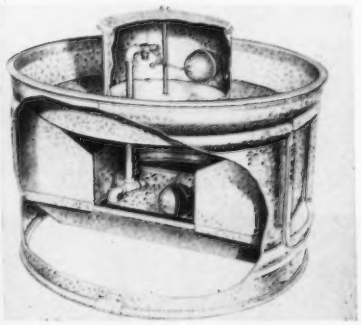
One lever controls five spreading rates and disengages the spreading mechanism, permitting the operator to unload manure onto a pile or to clean out the spreader after use. Triple staggered blade-like teeth on both upper and lower cylinders provide fine shredding. The paddles are designed with an involute curve, a shape that slices through the manure as it is thrown. Ten paddles are mounted in pairs and are individually replaceable without tearing down the distributor. The arch is slanted and out of the way of the hydraulic loader or barn cleaner.

Full length steel flares and steel endgate protect against damage by mechanical loaders. The box is constructed from yellow pine that is treated with water-repellent Penta preservative and then hot-painted.

(For more facts circle No. 97 on reply card)

Pipe-Line Stock Waterer

H. D. Hudson Mfg. Co., 589 E. Illinois St., Chicago 11, Ill., has announced a space-saving pipe-line waterer that serves cattle and hogs from the same unit. In a space only 3 ft in diameter, it provides both a cattle trough and two hog drinkers. It can



be used indoors or out, in the feed lot, loafing barn, or hog lot and keeps fresh, clean water before livestock the year around.

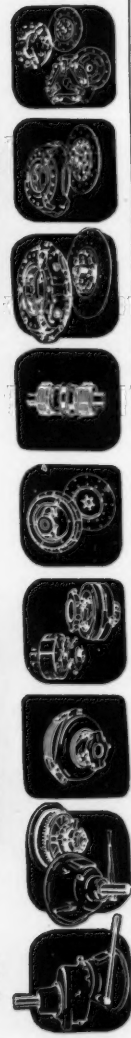
Features of the waterer include separate brass valves and copper floats to control both the cattle trough and hog drinkers; non-back-siphoning design with large capacity to maintain the desired water level; and operates on pressures up to 55 psi. Electric or gas heaters are available for winter use.

(For more facts circle No. 91 on reply card)

(Continued on page 120)

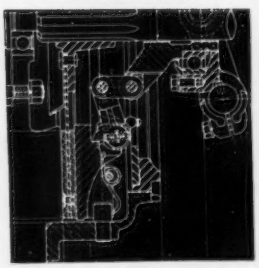
ROCKFORD

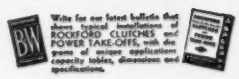
BALANCED CLUTCH LINKAGE



OFFSETS CENTRIFUGAL EFFECTS

Disengagement of ROCKFORD Over-Center Clutches is positive. It is accomplished by a linkage arrangement which is counter-balanced to offset the effects of centrifugal force — prevalent in modern *high-speed engines*. Give your product this and several other advantages — by specifying a ROCKFORD clutch.





Write for our latest bulletin that shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS, with dia-grams of unique applications, capacity tables, dimensions and specifications.

ROCKFORD Clutch Division BORG-WARNER

1325 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

ALEMITE Announces

the all-new SURGEPRUF LINES OF REUSABLE COUPLINGS AND RUBBER HOSE

...Available Now Nationwide!

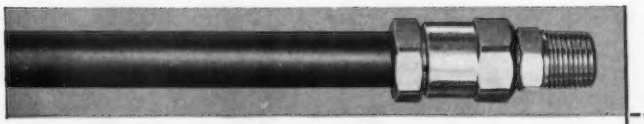
Now, for the first time, Alemite brings you a completely new line of *reusable, non-skive* couplings and hydraulic rubber hose—exclusively designed for faster, more economical replacements . . . to cut maintenance costs, downtime and inventories!

Rugged Alemite Surgepruf Couplings meet practically any original equipment or field replacement need. Hose are available for either medium-high or high-pressure service, with single or double wire braid. Couplings are made of high-strength steel . . . and J.I.C. thread design assures positive, long-lasting seal.

Contact your nearest Alemite Distributor for full details. Standardize—*save money*—on the complete new line of superior Alemite Surgepruf equipment!

Only Alemite Surgepruf Couplings Offer All These Advantages for Faster On-the-spot Replacements and Repairs!

- NO HOSE-SKIVING REQUIRED! "Double-wedge" grip forces coupling threads through rubber cover . . . grips either single or double wire braid solidly. Saves both time and labor!
- GIVES TIGHTER GRIP! Double-wedging action gives tighter grip as insert is drawn farther into coupling.
- NO SPECIAL ASSEMBLY TOOLS REQUIRED! Fast, easy assembly with just ordinary tools!
- TYPES AND SIZES FOR ALL HYDRAULIC LINES.



New Alemite Surgepruf Couplings and Hose Have Been Factory-tested and Field-proved!

ALEMITE
REG. U. S. PAT. OFF.

STEWART SW WARNER

Division of STEWART-WARNER CORPORATION

WRITE FOR FREE CATALOG

Alemite, Dept. RR-27
1850 Diversey Parkway, Chicago 14, Illinois

Please send me my free copy of the complete Surgepruf Catalog.

Name .....

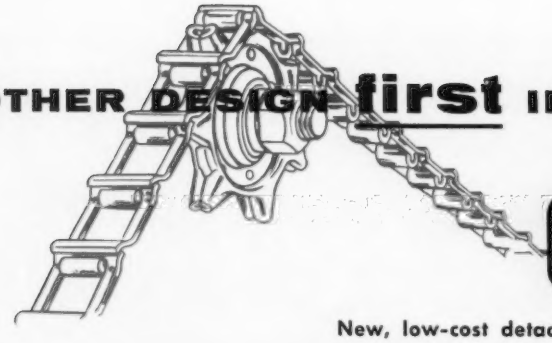
Company .....

Address .....

City ..... Zone ..... State .....

For more facts circle No. 15 on reply card

ANOTHER DESIGN first IN SPROCKET IDLERS



by

Aetna

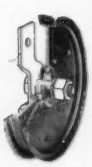
New, low-cost detachable link chain idler combines bearing, seals and sprocket wheel in a single, compact *package* unit to give you finer performance . . . longer life . . . greater economy . . . up to 66⅔ % saving in weight over solid cast steel idlers.

- Simple, weight-saving design. *Package* construction for easy, quick installation.
- Full complement of balls for greater capacity, 4-point ball contact for extra rigidity.
- Inner and outer bearing races case hardened for high fatigue and shock load resistance.
- Heavy gauge, case hardened steel teeth provide full contact-support area for chain cross bars.
- Large factory-packed lubricant chamber eliminates all need for relubricating.
- One-piece Buna-N rubber seals provide self-contouring positive contact; are corrosion and rust-free and exceptionally effective in excluding contaminants and retaining lubricant.
- Also available with teeth to fit standard or extended pitch roller chain.

This new detachable link chain idler is the latest addition to Aetna's growing line of sealed, pre-lubricated ball bearing *package* units which bring low-cost, anti-friction efficiency within the range of all light-duty moderate-speed equipment. All are quality built for top performance and dependability without maintenance of any kind. Write for complete data on the full line. Aetna Ball & Roller Bearing Company, Division of Parkersburg-Aetna Corporation, 4600 Schubert Avenue, Chicago 39, Illinois.

OTHER AETNA *Package* UNITS

GRAIN DRILL UNIT



ADAPTER UNIT

BELT IDLER UNIT

DISC HARROW UNIT

GRAIN ELEVATOR UNIT

Aetna

ANTI-FRICTION CONSULTANT TO LEADING ORIGINAL EQUIPMENT MANUFACTURERS SINCE 1916

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities
By John S. Davey

Tighten bolts to yield strength?

Actually, it is safer to "overtighten" than to undertighten. The following explains why.

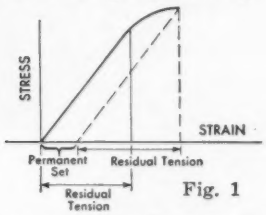


Fig. 1

Up to yield point, the strain in a bolt is proportional to stress. *Beyond* the elastic limit, the bolt goes into its "plastic range". Some permanent stretch takes place. (Fig. 1). Yet while the bolt will not return to original length, note that *residual tension* is fully maintained. And remember, it's *this* force that keeps a bolt tight, determines joint strength.

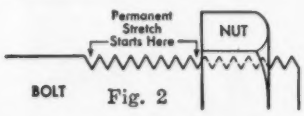
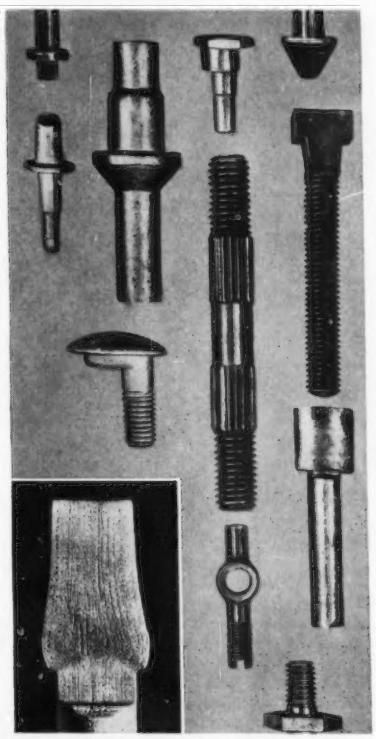


Fig. 2

The permanent set starts at section with highest unit stress —which is at the unengaged threads (Fig. 2). Ultimately, this throws thread pitch off and nut locks, subjecting bolt to torsion (rather than further tightening). This force disappears with wrench-removal. Thus, a bolt can even be torqued well into its plastic range if it won't be reused or need adjustment.

Cold facts on cold headed fasteners



RB&W cold heading machines have forced metal to flow into this typical variety of shaped pieces—just a handful of thousands of different cold headed shapes produced by RB&W to specification. The upset can be at any point, and the shape need not be symmetrical. The continuous, symmetrical flow lines (inset) make metal stronger.

NO ATTEMPT to simplify, improve or economize on fastening is complete without a good look at your screw machine parts, forgings, and certain assemblies that can be reduced to one piece.

You would be surprised at what an expert can produce on cold headers with complete uniformity. Cold heading produces in one piece parts that would otherwise be two or more.

BETTER FLOW LINES

Just as it does with standard fasteners, cold heading makes possible a higher quality, stronger product at high speed and low cost. Properly done, the operation upsets metal along its own axis in continuous flow lines without folds. Stress patterns are better. Fasteners and parts gain greater shear, impact and fatigue strength.

Long a specialist in cold headed fasteners, RB&W offers its experience to designers and production men who want to know whether cold heading is feasible for specific mechanical shapes. If it proves to be so, RB&W facilities can handle your volume needs. Contact Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

Spin-Lock® Screws solve assembly problem

The designer specified countersunk-head screws to be used in a particular casting. The production man had to stake these in to anchor them. But this meant extra operation, made screw removal damaging and difficult.

The answer was found in Spin-Lock screws. These have hardened "ratchet-action" teeth that bite in when tightened, take 20% more torque to loosen than to tighten, can be reused. Send for Bulletin.

Spin-Lock "tooth" about to bite in. Head meets seat when fully tightened.

For more facts circle No. 52 on reply card

ADVANTAGES OF FLEXIBLE SHAFTING for Power Drive and Remote Control

by C. HOTCHKISS, JR.
Application Engineer,
Stow Manufacturing Company

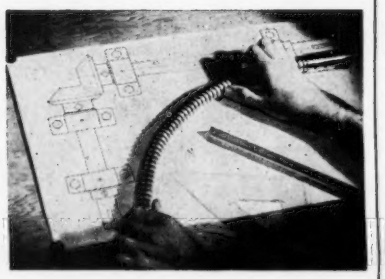
Flexible shafting has the following advantages over other type drives:

1 — It is often the simplest method of transmitting power between two points which are not collinear or which have relative motion

2 — eliminates exposed revolving parts

3 — does not require accurate alignment

4 — easy to install and maintain.



RELATIVE MOTION—Where two shafts which have relative motion must be connected, flexible shafting is often the ideal means of transmission. In many cases it eliminates a much more complicated drive which would, necessarily, include telescopic joints; further, it eliminates the danger of exposed moving parts. See figure 2, which shows a ¾-inch Stow flexible shaft driving an Avery Rake built by the Minneapolis Moline Co.

NOT COLLINEAR — Where it is necessary to connect two shafts which are not collinear, a simple arrangement of a single belt or two universal joints will often do the job adequately. But, in many cases where the path of transmission is more complicated and would require a more expensive arrangement of mechanical components, flexible shafting provides a simple, low cost, efficient drive which is easy to install because it does not require accurate alignment. See example, figure 1, in which a 1¼-inch Stow flexible shaft is used to drive the auger on a G.L.F. bulk feed truck.

Flexible shafting also allows the designer greater freedom in locating either the drive or the driven component on a piece of equipment.

Fig. 2

Other typical applications of this type are used on portable power tools when motors are too heavy to be mounted on the tool—such as portable grinders, sanders, paint scrapers, saws and tree tappers. And, since flexible shafting is not affected by vibration, it is an ideal drive for applications where a high degree of vibration is involved —such as in vibration testing tables and concrete vibrators.

Stow flexible shafts are available: for power drive applications in diameter sizes from ⅛ inch to 1¼ inches; for remote control applications in diameter sizes from ⅛ inch to 1⅝ inches.

The 1¼ inch power drive shaft will transmit up to 10 HP while the 1⅝ inch remote control shaft will transmit up to 4000 lb. in.

For complete engineering data on flexible shafting, including selection charts, write for engineering bulletin 570.

Fig. 1

STOW MANUFACTURING COMPANY
39 SHEAR STREET • BINGHAMTON, NEW YORK

. . . New Products

(Continued from page 116)

Winch for 4-Wheel Drive Bucket Loaders

Termac, PO Box 556, Libertyville, Ill., has developed a wheel winch for 4-wheel drive bucket loaders. It operates from the loader controls, utilizing the ability of this type of loader to raise the front drive wheels and disconnect the rear drive axle. With the front wheels off the ground and powered, the wheel-mounted winch rolls up the cable pulling the load toward the stationary vehicle.

When it is desired to move the load and vehicle at the same time, or to move the load over a distance exceeding the cable

length, it can be done by leaving the loader wheels on the ground and in all-wheel drive. With the cable secured to the load, a differential between the wheel rolling radius and cable drum diameters allows the load to move at a slower speed than the loader, and when the cable spool is nearly empty the rear axle is put in throw-out, the front wheels raised and the load towed in close to the loader.

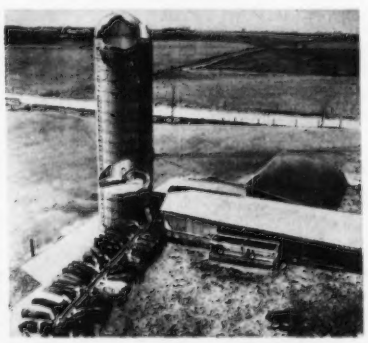
This unit can be used in logging, ditching, quarry or pit work, oil field and pipe line operations, and as a general utility tool for contractors.

(For more facts circle No. 1 on reply card)

Mechanized Feeding System

Clay Equipment Corp., Cedar Falls, Iowa, introduces a mechanized silage feeding set-up for the beef feeder or dairyman. A silo unloader pitches the silage into the end of a feed bunk, where a power-driven auger picks it up and distributes it along the bunks.

The operation is automatic and the com-



pany claims that these two machines will fill 50 ft of bunk in less than 15 minutes. This system features adaptability by using augers that can go around corners up to 90 deg by the use of universal joints. Thus, bunks can be curved around buildings or other obstacles.

(For more facts circle No. 89 on reply card)

Case "400" Tractor and Case 11'6" S wheel harrow with Crucible LaBelle discs.

it's the steel that makes *LaBelle* discs better!

It's a special kind of steel! It's different in a way from the tool, stainless or any of the other hundreds of special purpose steels Crucible produces. But, like them all, it is made expressly for its particular job.

Crucible formulates it with its end use in mind . . . gives it the precise combination of hardness and toughness required for the type of soil it will operate in . . . and grinds it prior to heat treating to insure a longer lasting edge despite highly erosive soil conditions.

Specify LaBelle discs. They're made for all makes of plows and harrows . . . and soil conditions.
Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

For more facts circle No. 44 on reply card

MANUFACTURERS' LITERATURE

Farm Drier for Grains

Aeroglide Corp.—This 21-page brochure illustrates and describes the Aeroglide farm drier. Specifications and capacities charts and data on the approximate gas consumption of farm driers are included, as well as detailed drawn plans of grain driers.

(For more facts circle No. 76 on reply card)

Fluid Power Equipment

The New York Air Brake Co., Kalamazoo Div.—Industrial fluid power equipment built by this company is presented in the 8-page illustrated bulletin No. 400. Hydreco gear and dual-vane hydraulic pumps, control valves, and cylinders are described. Condensed performance information is also included.

(For more facts circle No. 61 on reply card)

Flexible Chain Couplings

Morse Chain Co.—The 16-page flexible chain coupling catalog gives specifications, dimensions, ratings and application on series DSC, series SA silent chain couplings and series DRC roller chain couplings. Information is also tabulated on stamped steel covers, plastic covers and split aluminum covers. A general explanation of the purpose and function of flexible chain couplings is included.

(For more facts circle No. 81 on reply card)

ELECTRIC
Wheels Engineered for the Job
WRITE US FOR RECOMMENDATIONS
Rear Tractor Wheel for Demountable Rim
Planter Press Wheel—one piece rim with or without rubber tire
Pick-up Wheel Crown-face Steel Rim
Rear Tractor Wheel Reversible
Combine Wheel Reversible
Garden Tractor Wheel Reversible
Press and Gage Wheel Rubber Tire
Spreader Wheel
SAE Implement Wheel Reversible
ELECTRIC WHEEL COMPANY
2806 SPRUCE · QUINCY, ILLINOIS

Automatic Land Leveler

Eversman Mfg. Co.—A 4-page illustrated brochure discusses the company's new Model 329 automatic land leveler. It includes pictures of the leveler in action and points out the new additional structural and operational features.

(For more facts circle No. 77 on reply card)

Oscillating Conveyors

Link-Belt Co.—Book No. 2644, an 8-page illustrated booklet describes coilmount oscillating conveyors. Capacity and drive selection charts are shown and a table is included for selection of completely assembled stock sections.

(For more facts circle No. 78 on reply card)

20-Inch Drill Press

Delta Power Tool Division, Rockwell Mfg. Co.—This 4-page bulletin AD-1011 covers a description and the specifications of a new 20-in drill press. A table lists speed, feeds and capacities of the press. The bulletin shows 28 models of the press and a full line of accessories.

(For more facts circle No. 80 on reply card)

Oil Seal Catalog

Victor Mfg. & Gasket Co.—This 60-page catalog is said to be compiled from the customer's point of view. It tells and shows how to get needed shaft sealing equipment and points out the design features to be considered to assure desired oil seal performance.

(For more facts circle No. 82 on reply card)

Boss Fittings

Anchor Coupling Co., Inc.—SAE boss fittings catalog illustrates and describes a new line of boss fittings and O-ring adapters designed to satisfy the new SAE straight thread boss standards. These new adapters are now offered in a wide range of sizes and styles. Also shown are new tube nuts, available in short nut, SAE long nut and 3-piece assembly styles.

(For more facts circle No. 87 on reply card)

Shop Equipment

The Champion Blower & Forge Co., Inc.—Catalog No. 82 illustrates and describes various types of shop equipment such as blowers, forges, drills, vises, power hack saw machines, grinders, buffers, polishers, fans for heating, cooling, ventilating, drying and mechanical draft, tire shrinkers and benders, power hammers, etc.

(For more facts circle No. 90 on reply card)

Farm Quonset Buildings

Stran-Steel Corp.—A 24-page farm catalog shows a new line of quonsets, rigid-frame and bow-string truss buildings. It includes illustrated sections on units for farm shops and machinery storage; grain drying; specialized farm uses; livestock shelter; grain storage and cooling system, and hay drying, storage and self feeding. One section is devoted to building features.

(For more facts circle No. 79 on reply card)

Tractor Attachments

Caterpillar Tractor Co.—The 7-page pamphlet describes and illustrates tractor attachments; such as cabs, V-type snow plows, scarifiers, blade extension and shoulder finishers.

(For more facts circle No. 96 on reply card)

Compression and Flexure Testers

Forney's, Inc.—A one-page filler showing several models of compression and flexure testers manufactured by the company.

(For more facts circle No. 51 on reply card)

DURKEE-ATWOOD's *Little Professor reports . . .*

"Sugarbeets...1000's of 'em...

harvested *automatically* with BLACKWELDER'S amazing MARBEET HARVESTER... for as little as 45¢ per ton!"

One man . . .

harvests 3 to 5 acres per day . . .

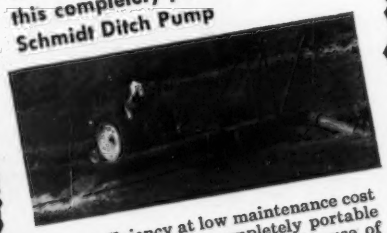
delivering up to 100 tons . . .

of *clean topped* beets!

The MARBEET Sugarbeet Harvester uses DURKEE-ATWOOD V-belts!

Blackwelder engineers saved beet farmers plenty of money when they designed the MARBEET. Now in use across the U.S. and abroad, this rugged machinery harvests *all* the beets, large and small, and delivers them *clean*. The MARBEET's unique power transmission and take-off network calls for top-flight performance. That's why Blackwelder engineers called on Durkee-Atwood for assistance in designing the rugged but gentle, foolproof and efficient transmission system. And that's why the MARBEET uses tough, long-lasting Durkee-Atwood V-belts exclusively . . . to keep beet harvesting costs low . . . even under wet and adverse conditions. Call on D-A . . . let Durkee-Atwood V-belt engineers help *you* with tough transmission problems.

Blackwelder Engineers also use Durkee-Atwood V-belts for this completely portable Schmidt Ditch Pump

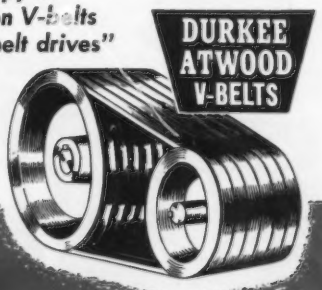


High efficiency at low maintenance cost is achieved in this completely portable self-contained unit through the use of Durkee-Atwood Multiple V-belts. One man can set up the pump in 5 minutes anywhere, ready to deliver up to 3200 G.P.M. from depths varying from 3 to 9 feet. Another example of how Durkee-Atwood V-belts help deliver peak performance. Let D-A engineers help you with your transmission design.

ATTENTION AG. ENGINEERS—

Get your FREE copy of "Handy Tips on V-belts and V-belt drives"

See your D-A distributor or write Dept. AG-2 for catalog that includes conversion tables, engineering data, latest Rubber Manufacturers Association horsepower ratings, drive selections and helpful Do's and Don'ts of V-belt operation.



DURKEE-ATWOOD
COMPANY
• Minneapolis 13, Minnesota

For more facts circle No. 99 on reply card

Acme

DOUBLE PITCH CHAINS become more popular with every application

Double pitch chains are becoming increasingly popular for applications where a precision roller chain is required and where cost is an important factor.

Acme's double pitch precision chain is available in standard steel and in a stainless steel line up to and including 1½" pitch for conveyors in the packaging, aircraft and many other industries. Stainless steel provides the greatest resistance to corrosion, which is an important factor in these industries.

If you use continuous process machinery in textile, agricultural, building, material handling, food processing, bottling or other fields, you should insist on Acme precision built double pitch roller chain. Acme stands up to your performance expectations.

Available from stock at your Acme distributor.

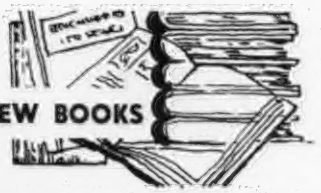
FREE CHAIN CATALOG

Write Dept. 9-F for your 80-page copy of Acme's latest catalog. Packed with valuable chain data. An indispensable chain reference.

Call ACME for Service

Acme Chain Corporation

HOLYOKE MASSACHUSETTS



Manual of Consulting Practice for Mechanical Engineers, prepared by the Committee on Professional Practice of Consulting Engineering of the American Society of Mechanical Engineers. Copies may be obtained from the ASME Order Department, 29 W. 39th St., New York 18, N. Y. at $1.50 per copy.

The 14-page booklet includes sections on ethics, methods of establishing fees, selection of the right engineer for a particular job and other subjects. The manual is intended to be of equal value to engineers and their clients. Its purpose is to help eliminate misunderstandings by providing basic information on the engineer-client relationship in general and outlining rules to cover such items as delay or termination of engineering projects, ownership and re-use of plans, ownership of patents and the protection of confidential information.

Farm Policies of the United States, 1790-1950: A Study of Their Origins and Development, by Murray R. Benedict. Cloth, 7×10 inches, xv+548 pages and indexed. Published by the Twentieth Century Fund, 330 W. 42nd St., New York 36, N. Y. $5.00.

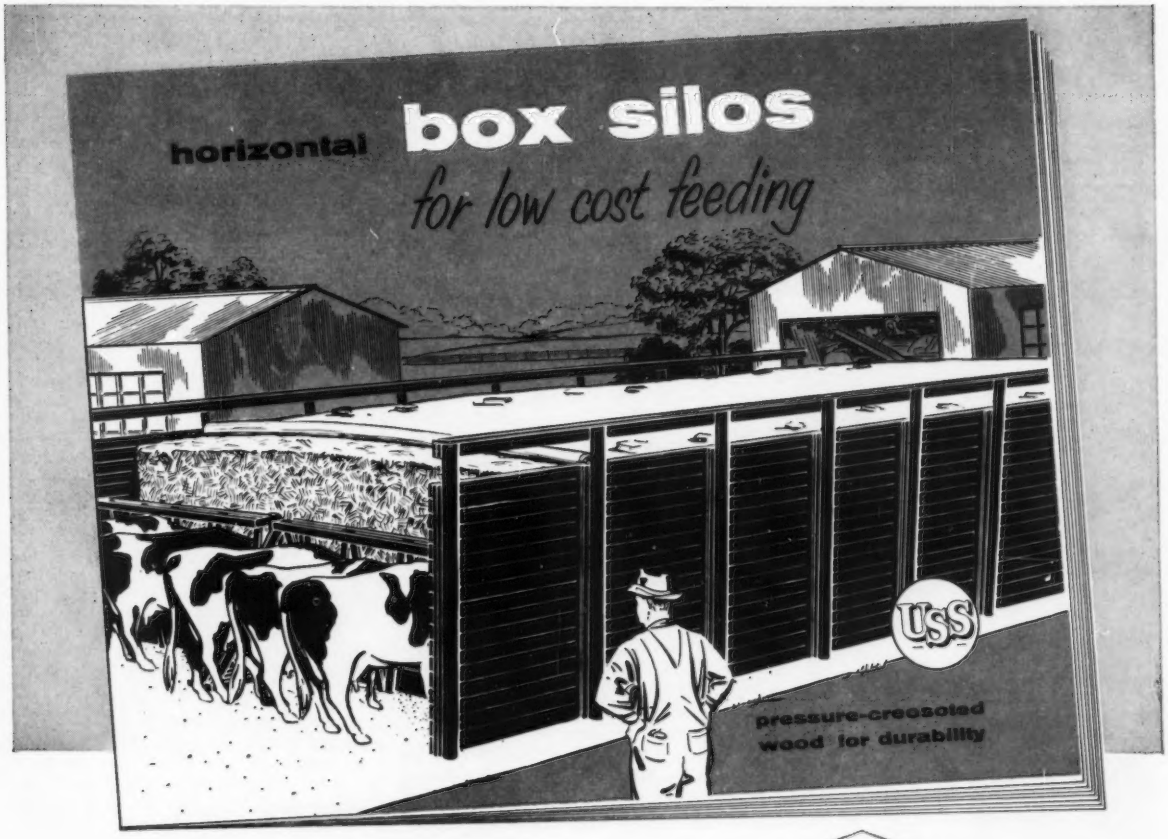
This is a long-range survey of the development of American farm policy from colonial times to the present. The author points out that American emphasis has always been on the rights and interests of the working farmer, and how more complex life has become.

The book is a record of evolution, controversy, change and growth in attitudes toward the farmer, his relations to government, his participation in politics; and of changing policy as to land tenure, government forests, mineral rights, water use, crop limitations, price supports, tariffs, cooperatives, regional developments such as TVA, and others. It forms a basis for working out solutions for the farm problems of tomorrow.

A World Geography of Forest Resources, edited for The American Geographical Society by S. Haden-Guest, J. K. Wright and Eileen M. Teclaff. Cloth, 7×10 inches, xviii+736 pages. Illustrated and indexed. The Ronald Press Company, 15 E. 26th St., New York 10, N. Y. $12.50.

This book presents a world-wide appraisal of our forest resources in terms of their natural functions and those that man has imposed on them. It deals with forests as the source of raw materials and tells what these materials are and whence they come. It briefly discusses the problem of how to sustain forest yields in the face of ever-changing demands.

The volume also considers the relationships of forests to rainfall and temperature, to relief and soils, and to human populations, institutions, needs, and desires. It will provide essential information for professional workers and students in the fields of forestry, geography, conservation, and ecology, and for the layman who feels concern for the present and future of the world's natural resources.



With this free booklet you can show farmers

how to build box silos

Labor Costs Are Cut! This free booklet shows farmers how to build horizontal box silos themselves and cut their labor costs practically in half. It shows farmers what size silo they need for their particular herd; gives them step-by-step construction details; tells them how to fill and pack the silo.

Cattle Feed Themselves! This booklet explains to farmers how cattle can feed themselves . . . how feed can be held over from good years to dry years.

Pressure-Creosoted Lumber! You can help farmers by advising them to build their silos with pressure-creosoted posts and lumber. By using this *protected* wood, their silos will remain sound and strong for decades.

USS CREOSOTE

Agricultural Extension
United States Steel Corporation
525 William Penn Place
Pittsburgh 30, Pennsylvania

Please send me a free supply of booklets on building horizontal box silos.

Name .....

Address .....

City ..... State.....

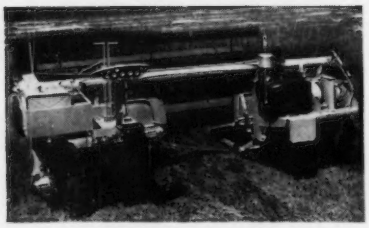
UNITED STATES STEEL

For more facts circle No. 29 on reply card

For top performance

on farm equipment more and more users depend on

KOHLER ENGINES



A grain swather like this needs a lot of power to operate, but the K660 Kohler Engine has it in abundance. Made by Minn-Kota Manufacturing Co., Moorhead, Minnesota.

The Michaels Mower in fence work which is one of its main uses—Michaels Machine Co., Mattoon, Illinois, uses the K90.

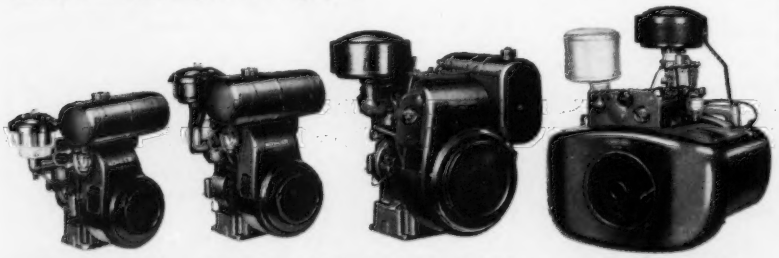
The Hanson Equipment Co., Beloit, Wisconsin uses Kohler K90 Engines for its sprayers.

Modern short stroke 4-cycle • Air-cooled

On a growing list of farm equipment, Kohler Engines are demonstrating cost-and-trouble-saving advantages that help to increase productiveness and profits.

Precision-built to Kohler quality standards, Kohler Engines insure full-rated power in a wide range of sizes, with maximum response to heavy loads, remarkable low speed performance, snappy all-weather starting. Large bore and modern short stroke cut engine friction, increase piston ring life, give utmost usable power. Fully anchored magneto has easily accessible outside breaker points. All models have liberal oil capacity—pressure lubrication on the two larger sizes, K330 and K660. The K660 has tapered roller bearings at both ends of the crankshaft, smaller models have ball bearings at both ends. Sturdy, compact design provides low weight per H.P. output. Special silencer muffler and large capacity oil bath air cleaner lessen noise. Smooth, balanced operation reduces equipment vibration, cuts wear, prolongs life.

Kohler branch offices are located in 16 principal cities. Sales and service organizations throughout the country have parts available and will assist you in selecting a Kohler Engine best suited to your needs. Write for information.



K90—1.8 to 3.6 H.P. K160—3.7 to 6.6 H.P. K330—8.2 to 12.5 H.P. K660—15 to 26.8 H.P. (2 cylinder opposed)

Kohler Co., Kohler, Wisconsin • Established 1873

KOHLER OF KOHLER

PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Baum, John A. — Agr. sales engr., Ohio Power Co., 605 Washington St., Portsmouth, Ohio

Bisley, Robert S.—Engr., A. M. Bisley and Co., Ltd., and Bisley Industries, Ltd., P.O. Box 239, Hamilton, New Zealand

Bouland, H. D.—Marketing Res. Div., Transportation and Facilities Br., AMS, USDA, Washington 25, D.C.

Bouse, Louis F. — Agr. engr., ARS, USDA, Agr. engr. dept., Oklahoma A & M College, Stillwater, Okla.

Bryan, George E. — Gen. mgr., Ti-Ti Peat Humus Co., Green Pond, S. C.

Bucher, David H. — Student, Pennsylvania State College (Mail) 1131 W. Main St., Palmyra, Pa.

Burdick, William F. Sr.—Special rep., indus. prod., Goodyear Tire & Rubber Co. (Mail) 3919 Twenty-Third Ave., Rock Island, Ill.

Chaney, Ralph E.—Mfrs. rep. (Mail) 2114 22½ Ave., Rock Island, Ill.

Click, David E.—Lt., USAF, Shaw Air Force Base, S.C. (Mail) R.R. 5, Spokane, Wash.

Clingerman, John L. — Design engineer trainee, Deere and Co., John Deere Wagon Works, Moline, Ill. (Mail) R.R. 1, St. Paris, Ohio

Cokeley, William L. — Agr. engr., SCS, USDA, Olympia, Wash. (Mail) R.R. 4, Box 140.

Copley, Russell D. — Student engr., John Deere Des Moines Works, Des Moines, Iowa (Mail) 209 Cherry, Ankeny

Davies, Richard L.—Dir. of res. proj., Nuffield Foundation, Nuffield Lodge, Regents Park, London, N.W. 1, England

Decke, Lynn H.—Sales mgr., Grand Ledge Clay Products Co. (Mail) 912 Three Mile Rd., N.E., Grand Rapids, Mich.

Durland, George R.—Asst. ext. agr. engr., agr. engr. dept., South Dakota State College, College Station, Brookings, S.D.

Dvorak, Verne I.—Hydrologist, SCS, USDA, Lincoln, Nebr. (Mail) 1238 S. 14th St.

Eickmeyer, Irvin A.—Student, University of Illinois (Mail) 109 S. Busey Ave., Urbana, Ill.

Equrrola, Manuel P.—Supervisor tech. dept., Massey-Harris-Ferguson, Ltd., Toronto, Ontario, Canada (Mail) 59 Sultana Ave.

Fenzl, Richard N. — Graduate asst., New York State College of Agriculture, Cornell University, Ithaca, N.Y. (Mail) 409 Elmwood Ave.

Folmar, Glenn D. Jr. — Sales engr., Food Machinery & Chemical Corp., John Bean Div. (Mail) 4105 Gaylark Rd., Mobile, Ala.

Ford, Perry — Sr. draftsman, John Deere Planter Works, 501 3rd Ave., Moline, Ill.

Gentry, Joe P.—Student, Oklahoma A & M College, P.O. Box 75 VV, Stillwater, Okla.

Hamann, Donald D. — Asst. in agr. eng., South Dakota State College, Brookings, South Dakota

(Continued on page 129)

LOOK at this NEW IDEA!

CHECK THESE PROFITABLE FEATURES!

THIS MOUNTED model transplanter is more maneuverable, permitting operator to get close to fences, make shorter turns. Two 55 gallon water tanks can be mounted on tractor. It has an EXCLUSIVE new seating arrangement which has hinged leg and foot rests that automatically adjust for greater comfort.

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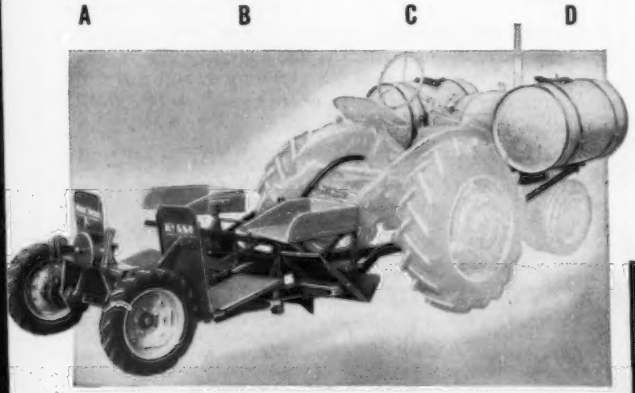

Maneuverability, efficiency, earlier maturity for crops all add up to make this New Idea *enticing to the farmer.*

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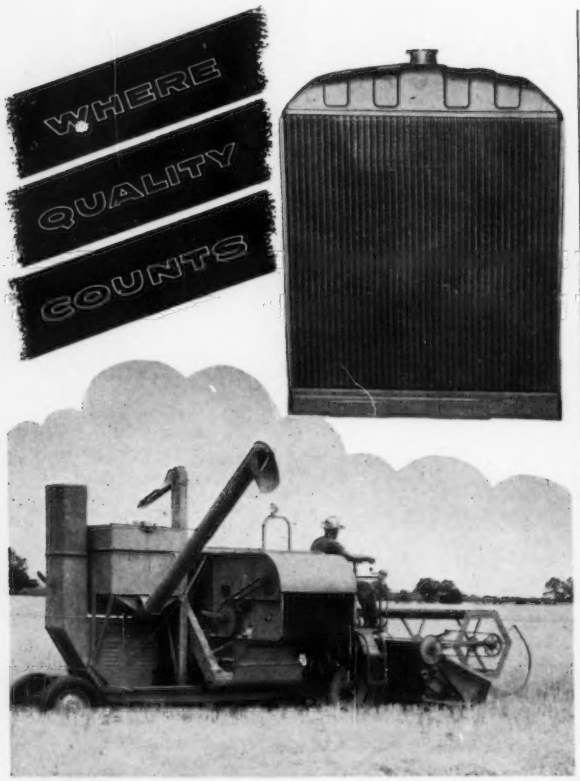

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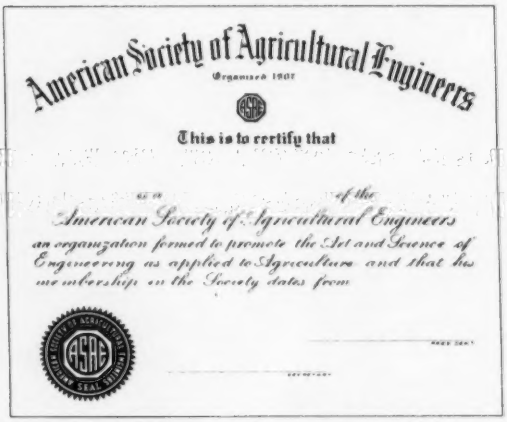
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(Continued from page 126)

Hilligas, John—Owner and operator, John Hilligas Trenching Service, 1860 Wilder Rd., Bay City, Mich.

Howe, Orville — Owner and operator, Orville Howe Farm Trenching Service, R.R. 1, St. Charles, Mich.

Jenny, Bernard T.—Jr. designer, New Holland Machine Co., New Holland, Pa. (Mail) Box 314, R.R. 6, Lancaster.

Karber, Larry A.—Owner, Karber Block & Tile Co., 817 Church St., St. Johns, Mich.

Lance, Edwin V.—2nd Lt., US Army Corps of Engrs., Ft. Lewis, Washington (Mail) 5095 Bailey Rd., Salem, Ore.

Leander, Jan E. — Exec. vice-pres., Trelleborgs Gummifabriks Aktiebolag, Trelleborg, Sweden

Lecaroz, Anton C. — Salesman, General Equipment Corp. (Mail) Central Soller, Camuy, Puerto Rico

Mesler, Robert J. Jr. — Design and equip. group, Dow Chemical Co., Midland, Mich. (Mail) 3314 Boston St.

Milani, Mario J. — Agr. engr. SCS, USDA, 1634 E. Harding Way, Stockton, Calif.

Mitzner, Raymond C. — Engr., Rilco Laminated Products Co., Inc., St. Paul, Minn. (Mail) 308 Birmingham St.

Naffziger, Loy M.—Agr. engr., ARS, USDA, Washington State College, Box 448, College Station, Pullman, Wash.

Opersol, Jerry K. — Owner and operator, J. K. Opersol Drainage Contractor & Tractor and Implement Sales, R.R. 2, Blissfield, Mich.

Parker, Arthur J. — Owner and operator, Arthur J. Parker Farm Trenching Service, 11625 Frost Rd., R.R. 3, Freeland, Mich.

Peterson, Thomas M. — Layout draftsman, International Harvester Co., Stockton, Calif. (Mail) 604 N. Commerce St., Apt. 15

Pohl, Alvin J.—R.R. 3, Box 117, Hallettsville, Tex.

Quackenbush, Stanley R. — Drainage engr., Michigan State Dept. of Agriculture, Div. of Agricultural Industry, Lewis Cass Bldg., Lansing 13, Mich.

Ratliff, Elwood F. Jr.—Asst. agr. eng., Mississippi Agricultural Experiment Station (Mail) General Delivery, State College, Miss.

Reeder, Edwin W. — Student engr., John Deere Planter Works, 503 3rd Ave., Moline, Ill.

Singletary, Willie L. — VA teacher, Green Bay High School (Mail) R.R. 5, Box 182, Palestine, Tex.

Spinabella, William—Power use spec., Shome Power Corp., Marshfield, Mo.

Spitler, Cecil S. — Sales engr., Southwest Equipment Co., Dallas, Tex. (Mail) 2825 Storey Lane

Steuerwald, Wilfred L. — Jr. engr., John Deere Harvester Works (Mail) 600 East North St., Geneseo, Ill.

Stocking, James W.—Superintendent, Pittsburgh Forgings Co., Coraopolis, Pa.

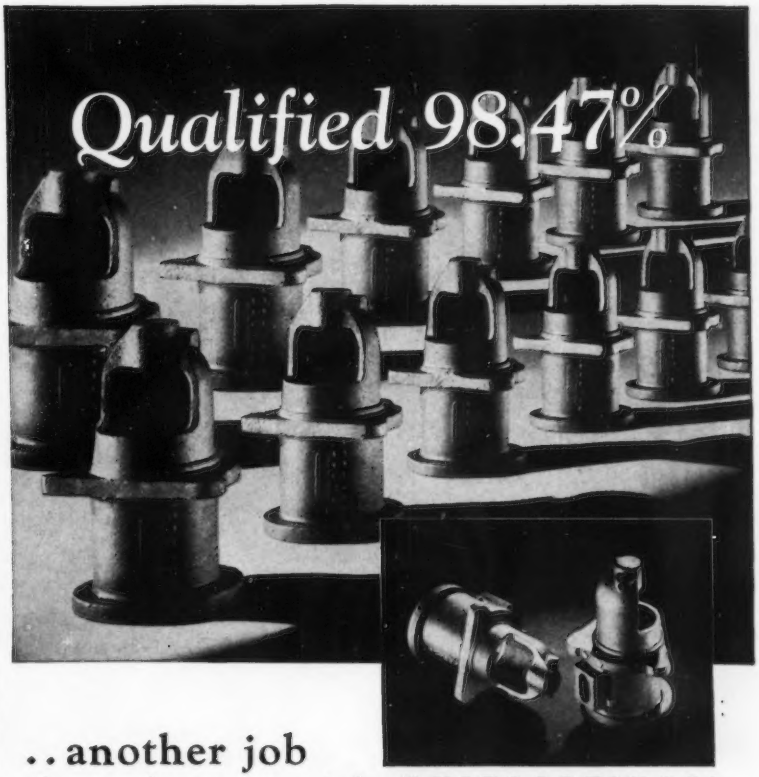
Thompson, Arthur H.—Farmer, c/o J. N. Thompson, Noyes Mills Rd., Limestone, Maine

Vidal, Francisco F. — Vice-president, Agricola El Vardin, S.A., Ave de Menocal 16, Apt. 706, Havana, Cuba

Vogel, Walter—Industrial engr., John Deere Waterloo Tractor Works, Waterloo, Iowa (Mail) 225 Sunnyside Ave.

Walker, Delos A.—Asst. chief engr., International Harvester Co., Memphis, Tenn. (Mail) P.O. Box 268

(Continued on page 134)



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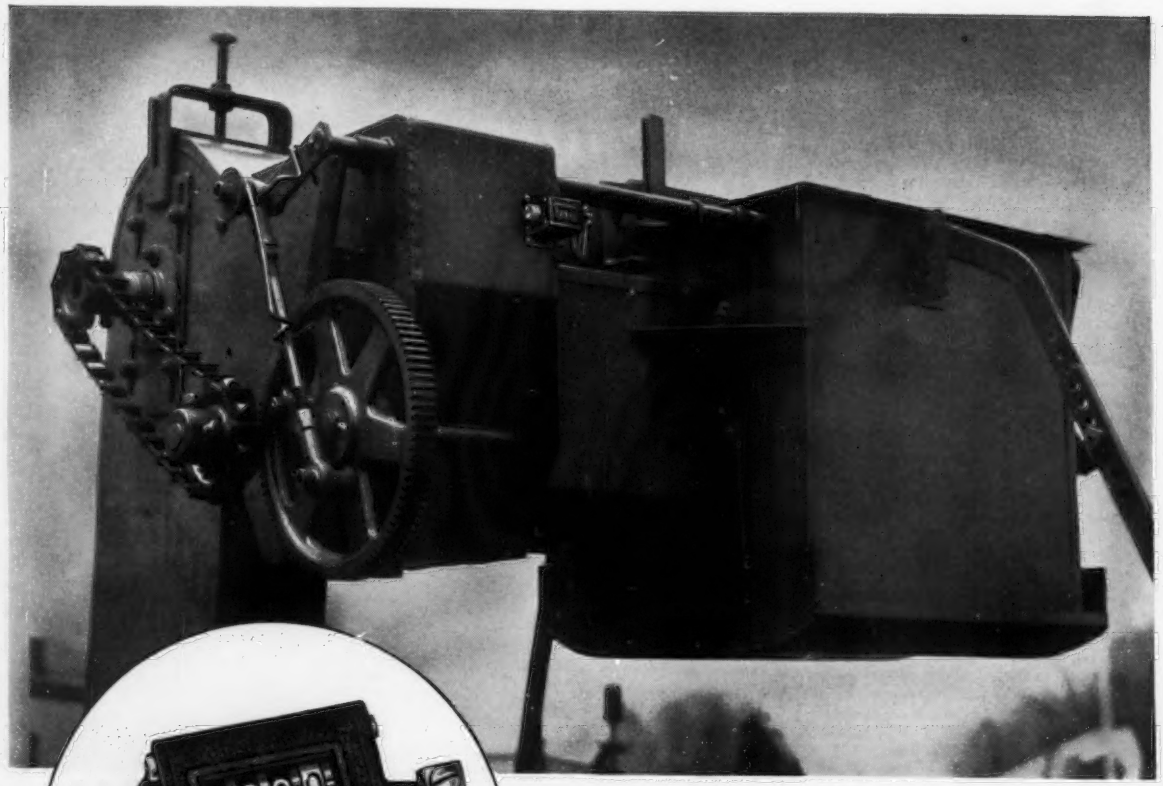

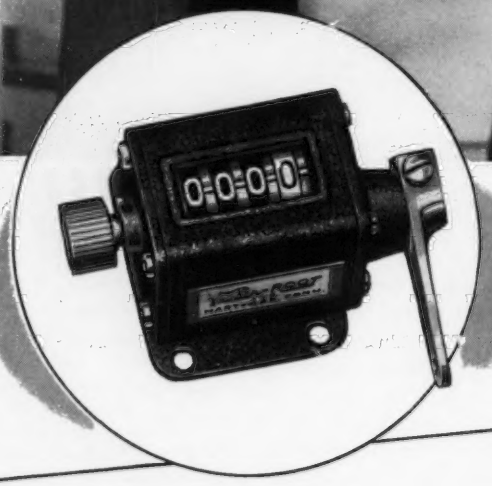

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6	16	26	36	46	56	66	76	86	96
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4	14	24	34	44	54	64	74	84	94
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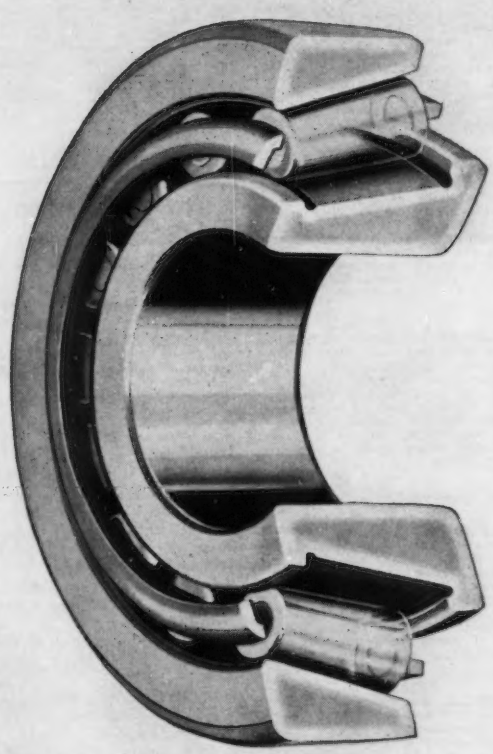

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PERSONNEL SERVICE BULLETIN

NOTE: In this bulletin, the following listings current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer," as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this Bulletin, request form for Personnel Service listing.

POSITIONS OPEN — 1956 — SEPTEMBER — O-271-650, 305-651, 307-652, 292-653, 314-654. OCTOBER—O-330-655, 316-656. NOVEMBER—O-252-657, 363-658, 365-660, 365-661, 365-662, 382-663. DECEMBER — O-374-664, 374-665, 384-666, 385-667, 388-668, 394-670, 393-671, 396-672, 401-673, 402-674. 1957 — JANUARY — O-414-675, 416-676, 453-677, 8-701.

POSITIONS WANTED — 1956 — SEPTEMBER — W-359-30. OCTOBER — W-315-31, 323-33, 328-34, 332-35. NOVEMBER—W-255-36, 379-37. DECEMBER—W-377-38, 366-40. 1957—JANUARY—W-405-42, 413-43, 419-45, 422-46, 420-48.

NEW POSITIONS OPEN

HYDRAULIC ENGINEER for design and development of farm tractor hydraulic equipment with established manufacturer in Canada. General engineering experience on the design of farm tractor hydraulics. Good opportunity for advancement. Salary open. O-14-702

ASSISTANT CHIEF ENGINEER for design and development of farm tractors with established manufacturer in Canada. Extensive knowledge of farm tractor design, including engines and transmissions. Good opportunity for advancement. Salary open. O-14-703

PRODUCT ENGINEERS to design frameless, rigid-frame and truss-type prefabricated steel buildings with a leading manufacturer in Midwest. Age, about 25. BS deg in agricultural engineering, with major in farm structures. No previous industrial experience required. Prefer writing ability and interest evidenced by past activity. Desire to work in structural design. Company practices policy of "promoting from within." Salary $450-$500 per mo. O-23-704

SALES ENGINEER to call on customers in railroad, highway and heavy construction markets to sell metal drainage structures with a leading midwestern manufacturer. Initial year in training program at home office in Midwest. Could then be assigned to any section of U.S. Age, about 25, BS deg in engineering. No experience required. Must be personable, aggressive, and interested in sales work. Future military obligations not necessarily an obstacle. Company "promotes from within." Salary $450 per mo. O-23-705

AGRICULTURAL MARKET SPECIALIST to promote use of company products with manufacturers of agricultural equipment, by editing promotional literature and by personal contact work, with steel component producer in Midwest. Age, about 25. BS deg in agricultural engineering, with major in power and machinery. No experience required. Prefer writing ability and interest evidenced by past activity. Personable, creative, and aggressive, with enthusiasm for contact work. Immediate opportunity. Can only consider men who have completed military active duty obligations. Company "promotes from within." Salary $450-$500 per mo. O-23-706

DESIGN ENGINEER, for work on processing equipment with established poultry equipment manufacturer in Midwest. Age, 25-35. Mechanical engineering design training or equivalent, and some acquaintance with food handling and agricultural products. Experience in metal fabrication, machine design and drafting, poultry and food handling equipment desirable. Desire to learn and stay with an interesting branch of the food processing equipment industry, in wide range of equipment design engineering rather than highly specialized function. Considerable opportunity for progress as design engineer, field engineer, production engineer, or chief engineer. Salary open. O-12-707.

GRADUATE ASSISTANTS (several) for research in farm structures, farm electrification, or farm power in midwestren land grant university. BS deg in agricultural engineering or its engineering equivalent. Interest in research and desire to pursue graduate program leading to MS deg. Twelve-month appointment for 11-month duty and one month vacation. Well prepared student can complete requirements for MS deg in one calendar year. Salary $2,000-$2,400 on half-time basis. O-28-708

AGRICULTURAL ENGINEER for development of original plans for farm buildings and dwellings under senior engineer with established component material manufacturer. Midwest location. Age, 21-26. BS deg in agricultural engineering in farm structures field. Farm background. Desire to learn building design in sales engineering office. Opportunity for advancement to promotion and sales work in farm field. Salary open. O-38-709

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER for extension or research in rural electric or soil and water field with manufacturer or federal agency anywhere in USA. Will travel. Single. Age 32. No disability. Available now. BS deg in agricultural engineering, University of Tennessee, 1952. Farm background. Experience 2 years on electrical transmission, distribution and construction of power lines; 4 years designing, selling, and installing irrigation equipment. Salary open. W-364-47

AGRICULTURAL ENGINEER for development, sales, service or management, original equipment sales engineer, or promotional work in power and machinery or product processing field with industry, anywhere in USA. Interested in responsibility, challenge, and future opportunity. Married. Age 35. No disability. Available on 30 days notice. Farm background. Sales and related work in farm equipment fields, 6 years. Additional experience as product planning and programming analyst with manufacturer. War non-commissioned experience in Air Corps as welder and aircraft mechanic. Salary open. W-13-1

AGRICULTURAL ENGINEER for sales, service, writing or management in power and machinery field with manufacturer, processor or distributor in central or southern USA. Limited travel. Married. Age 28. No disability. Available on reasonable notice. BS deg in agricultural engineering, 1950, Texas A and M College. Soil Conservation engineering 12 mo. Construction and maintenance engineering 14 mo. Photogrammetric survey and mapping, water right record abstracting, 16 mo. Registered professional engineer in New Mexico. Armed Forces commissioned service 3 years in heavy antiaircraft artillery, supervising use and maintenance of electronic computer and radar. Salary open. W-33-2

AGRICULTURAL ENGINEER for design, development or research in power and machinery with public service or industry, anywhere in USA. Married. Age 29. No disability. Available June 15. BS and MSAE deg in 1950-1954, University of Maine. Ph D. expected in June from Cornell University. Farm background. Graduate research and related design and development of experimental machines 4 years. Army service 2 years. Salary open. W-10-3

. . . Applicants

(Continued from page 129)

Wiersma, Frank — Asst. agronomist, South Dakota State College, College Station, Brookings, S.D.

Wren, Henry H.—General mgr., Lee Wilson and Co., Wilson, Ark.

Wurfel, Alvin J.—Owner and operator, Alvin J. Wurfel Farm Trenching Service, R.R. 1, Marlette, Mich.

Transfer of Membership Grade

Ackley, John W.—Sr. product engr., John Deere Planter Works, 501 3rd Ave., Moline, Ill. (Associate Member to Member)

Beville, Bishop C.—Area engr., SCS, USDA, Gainesville, Fla. (Mail) 2336 Goldenrod St., Sarasota, Fla. (Associate Member to Member)

Johnson, William H. — Asst. prof., Ohio State University, Columbus, Ohio (Associate Member to Member)

Lamp, Benson J. Jr.—Asst. prof., Ohio State University, Columbus, Ohio (Associate Member to Member)

Liu, Robert C. — Res. fellow, University of Minnesota, St. Paul 1, Minn. (Associate Member to Member)

Reid, James T.—Asst. agr. engr. res., University of Georgia, Athens, Ga. (Associate Member to Member)

Stott, Ted—Eng. supervisor, New Idea Farm Equip. Co., Coldwater, Ohio (Mail) 610 Willow St., Celina (Associate Member to Member)

Woodruff, Neil P.—Agr. engr., ARS, USDA, agronomy dept., Kansas State College, Manhattan, Kans. (Associate Member to Member)

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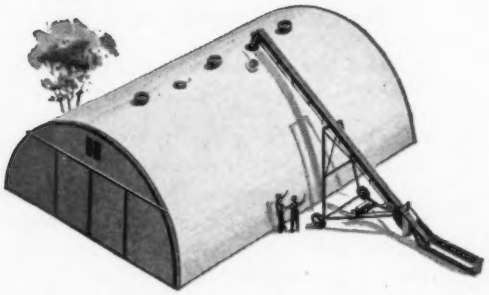
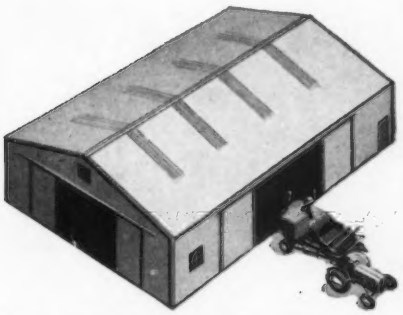
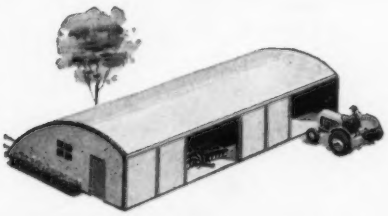


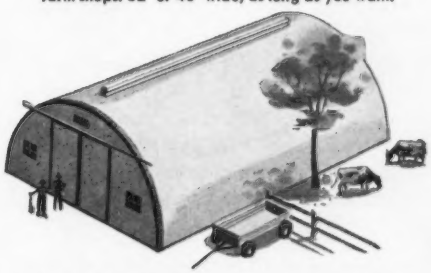
Quonset 40—Most dollar value in a farm building! Post-free storage for machinery and farm crops. Ideal for livestock. And it's designed for the Quonset Grain Drying System.



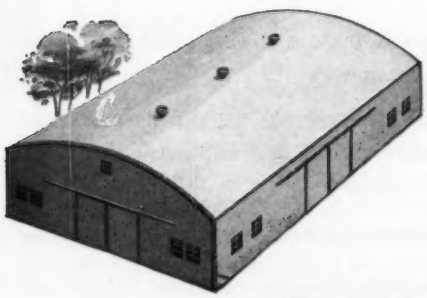
Rigid Frame Building—Versatile money-saver for your farm. Easy in-and-out and drive-through machinery storage. Spacious for storing hay. Perfect for feed-grinding facilities, live stock and farm shops. 32′ or 40′ wide, as long as you want.



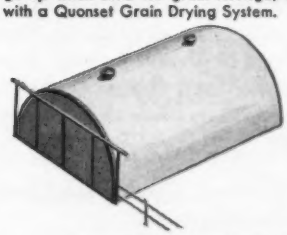
Quonset 24 Special—All-steel quality means this low-cost building will last a lifetime. Used widely for livestock shelter with open front, and for machinery storage with sliding doors.



Quonset 32—Proved best for loose-housing or stanchion barns. Expand the "32" right along with your herd for maximum economy. Profits go up when used for grain storage; especially with a Quonset Grain Drying System.



Bow String Truss—Really low per-bushel cost for large volume grain storage. With a Quonset Cooling System, grain is extra safe. Provides maximum efficiency when used to centralize operations under one roof. 50′ or 60′ wide.



Quonset 20—A workhorse for economy! Ideal for grain storage, and available with Quonset Drying System. Serves as handy utility building for seed, feed, fertilizer and other supplies.

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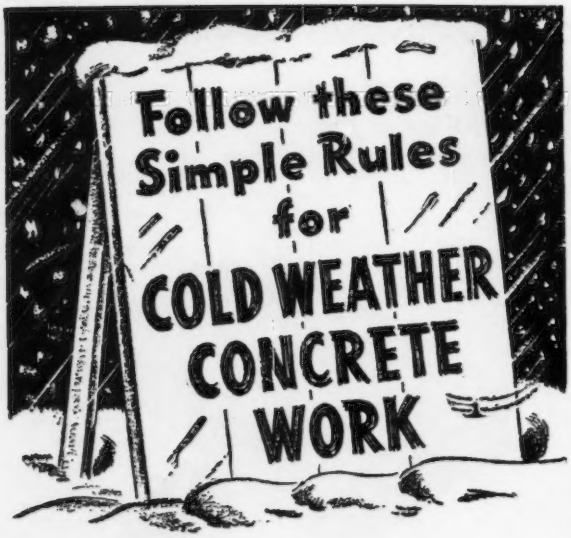

AFTER the last crops are in farmers usually have more time for construction work. Concrete improvements can be built in winter just as well as in summer, but certain precautions must be observed. These are:

1. **HEAT MATERIALS.** Concrete should be between 60° and 80° F. when placed in the forms. Heat sand and coarse aggregates separately until all frost, ice or snow disappears. The water should never be hotter than 175° F. when it comes in contact with the portland cement in the mix—otherwise a flash set may result.

   In above-freezing weather heating the water or putting a heater on the mixer may be all that's necessary to bring up the temperature of the mix.

2. **MIX CAREFULLY** so that concrete is as stiff as possible and yet will place and finish properly. Never add salts or chemicals to *prevent freezing.* Small amounts of calcium chloride (2 lb. per sack of cement) may be used to *accelerate the hardening.*

3. **CLEAN FORMS** of all frost, ice and snow.

4. **THAW GROUND** if it is frozen. Never place freshly mixed concrete on frozen ground.

5. **PROTECT CONCRETE FROM FREEZING.** Flat work can be protected with heavy paper and 10 to 12 in. of hay or straw. Walls and other structural members must be enclosed with canvas and kept warm. Do not remove forms until concrete has had time to harden properly. Normally concrete must be maintained at 50° F. or higher for five days after placing. However, with high-early-strength concrete this time period may be reduced.

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FACTS

about

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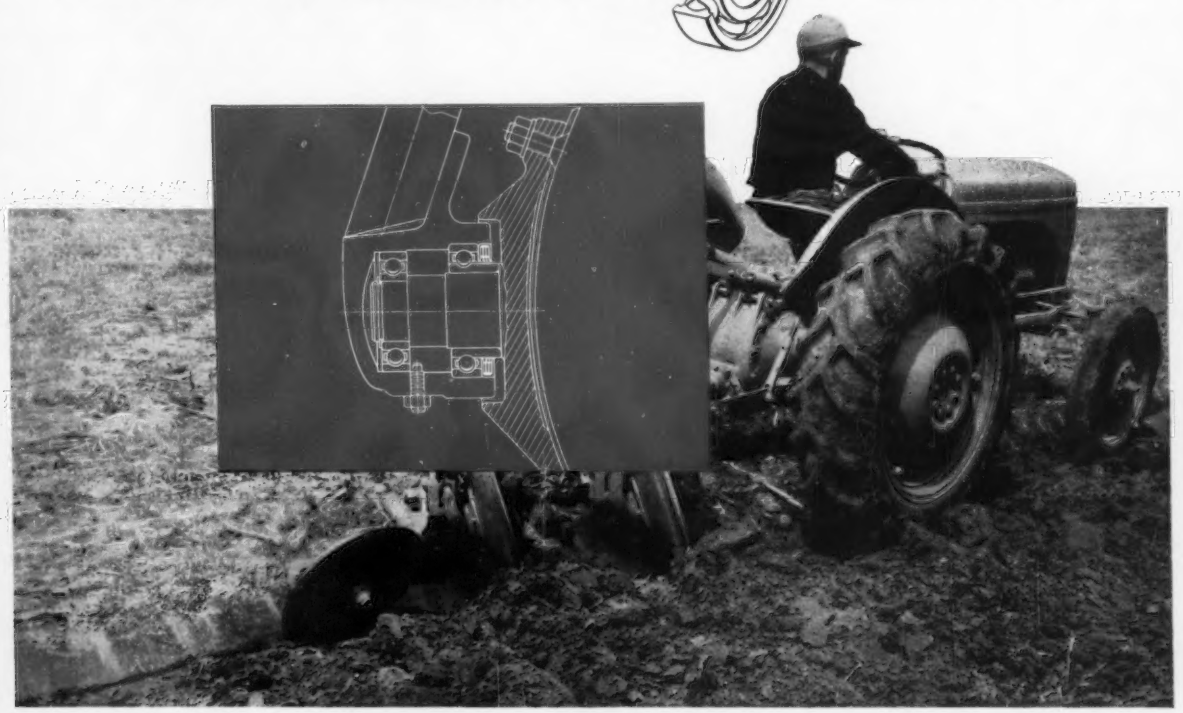

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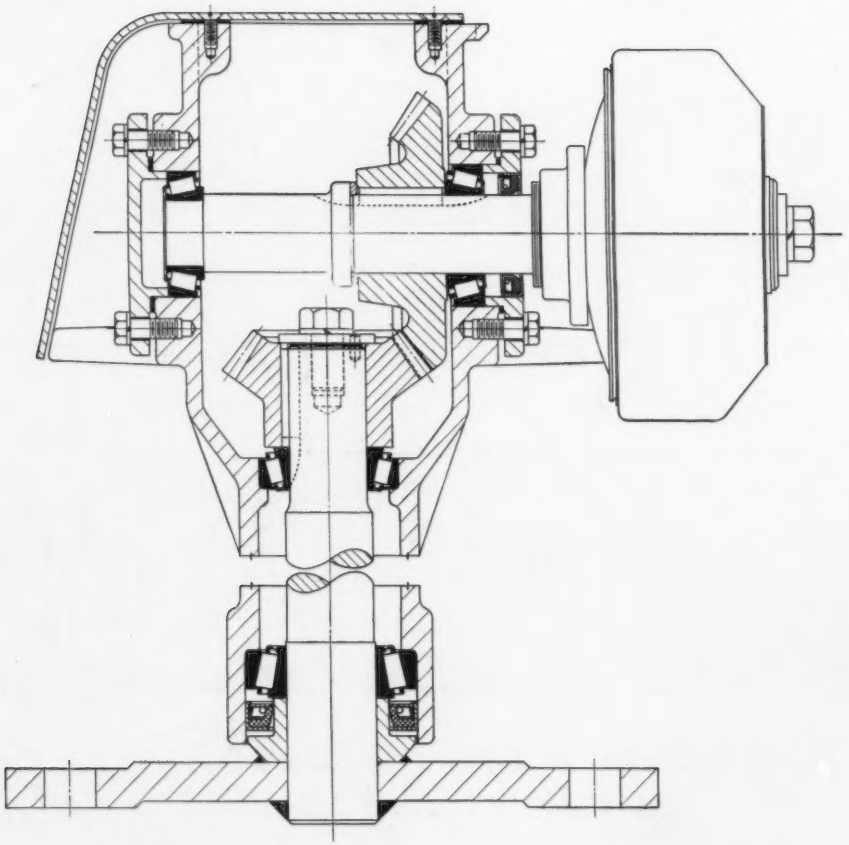

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